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1987 Federal Interim Storage Fee Study: A Technical and Economic Analysis

September 1987

**Prepared by E.R. Johnson Associates, Inc.
for Pacific Northwest Laboratory
under Contract DE-AC06-76RLO 1830
with the U.S. Department of Energy**

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1987 FEDERAL INTERIM STORAGE FEE STUDY:
A TECHNICAL AND ECONOMIC ANALYSIS

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September 1987

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ABSTRACT

This document is the latest in a series of reports that are published annually by Pacific Northwest Laboratory (PNL) for the U.S. Department of Energy (DOE). This information in the report, which was prepared by E. R. Johnson Associates under subcontract to PNL, will be used by the DOE to establish a payment schedule for interim storage of spent nuclear fuel under the Federal Interim Storage (FIS) Program, which was mandated by the Nuclear Waste Policy Act of 1982. The information in this report will be used to establish the schedule of charges for FIS services for the year commencing January 1, 1988.

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1986 FEDERAL INTERIM STORAGE FEE STUDY
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1.0 INTRODUCTION

The Nuclear Waste Policy Act of 1982 enacted on January 7, 1983 (Pub. L. 97-425, 96 Stat. 2201, 42 U.S.C. 10101 et seq., referred to herein as "the Act") established, among other things, a Federal Interim Storage (FIS) Program for spent nuclear fuel from domestic civilian power reactors. This program is intended to ensure the continued orderly operation of such reactors where at-reactor storage cannot reasonably be provided soon enough, as determined by the Nuclear Regulatory Commission (NRC), to prevent a disruption of operations. Sec. 136(a)(2) of the Act provides that the Secretary of Energy (the Secretary) undertake a study to establish payment charges for FIS of spent fuel and report the results to Congress not later than 180 days after the date of enactment of the Act.

In accordance with this requirement, the Department of Energy (the Department) prepared and submitted a report to Congress entitled Payment Charges for Federal Interim Storage of Spent Nuclear Fuel from Civilian Nuclear Power Plants in the United States, DOE/S-0022, dated July 1983. The report was supplemented by a more detailed technical, contractual, and economic study and analysis which was contained in a report entitled Federal Interim Storage Fee Study for Civilian Spent Nuclear Fuel: A Technical and Economic Analysis, DOE/S-0023, dated July 1983. These reports formed the basis for the payment charges for Federal Interim Storage (FIS) services which were published in the Federal Register on December 2, 1983 and became effective on January 1, 1984 (F.R. 48:54391).

Under the provisions of the Act, the Department may revise these payment charges no more frequently than annually to reflect changing conditions. In preparation for the possibility of a revision to the payment charges for FIS services for 1987, E. R. Johnson Associates, Inc. (JAI) was asked to review and analyze DOE/S-0022 and DOE/S-0023 and to update the content thereof to provide a basis for the Department to establish the payment

charges^{1/} for FIS services in the Federal Register for the year commencing January 1, 1987. The results of this update were reported in a document entitled, 1986 Federal Interim Storage Fee Study: A Technical and Economic Analysis, PNL-6031, dated September 1986.

In preparation for the possibility of a revision to the payment charges for FIS services for 1988, JAI was asked to:

- o Review the data base of information that was used in the previous fee determinations (for 1984, 1985, 1986 and 1987).
- o Prepare estimates of costs for capital, operating, and decommissioning each of the FIS facilities cases reported on in PNL-6031.
- o Update spending schedules for each of the FIS facilities cases reported on in PNL-6031.
- o Review the fee structure to ensure that it will recover government expenses in a way that eliminates or minimizes the need for appropriations of federal funds to provide FIS. Since it is the Department's current position that funds will not be appropriated for FIS purposes and that procurements will be authorized only from funds available in the Interim Storage Fund, it is important that the fee structure provides funds for FIS expenditures in advance of the time the expenditures are made.
- o Recommend the magnitude of the fee to be collected from FIS users based on the background information and fee structure reviews noted above.

As a result of this work, JAI has updated the content of PNL-6031 to provide a basis for the Department to establish payment charges for FIS services in the Federal Register for the year commencing January 1, 1988. This report describes the results of the update which was performed.

^{1/} The terms "payment charges", "charges", "fee" and "unit cost" have been used interchangeably throughout this report and, therefore, have identical meanings.

2.0 SUMMARY AND CONCLUSIONS

JAI examined alternative methods for structuring charges for FIS services and concluded that the combined interests of the Department and the users would be best served, and costs most appropriately recovered, by a two-part fee involving an Initial Payment upon execution of a contract for FIS services followed by a Final Payment upon delivery of the spent fuel to the Department.

The Initial Payment would be an advance payment covering the pro rata share of preoperational costs, including (i) the capital costs of the required transfer facilities and storage area, (ii) development costs, (iii) government administrative costs including storage fund management, (iv) impact aid payments made in accordance with section 136(e) of the Act, and (v) module costs (i.e., storage casks, drywells or silos).

The Final Payment would be made at the time of delivery of the spent fuel to the Department and would be calculated to cover the sum of the following:

- (i) any under-or over-estimation in the costs used to calculate the Initial Payment of the fee (including savings due to rod consolidation), and
- (ii) the total estimated cost of operation and decommissioning of the FIS facilities (including government administrative costs, storage fund management and impact aid).

The module costs were included in the Initial Payment to preclude the possible need to obtain appropriations for federal funds to support the purchase of the modules in advance of receipt of the Final Payment.

Charges for the transport of spent fuel from the reactor site to FIS facilities would be separately assessed at actual cost since these will be specific to each reactor site and destination.

The Initial Payments received from all users would provide the funds necessary to design, license (as applicable) and construct the FIS facilities, to pay for storage modules, and to repay any funds borrowed from the U.S. Treasury that may have been needed earlier. The Final Payments received would also include an adjustment for differences between the actual preoperational costs and those used to calculate the Initial Payment, and the estimated future costs of facility operation.

JAI estimated the charges that would have to be made for the FIS of commercial spent fuel by each of three different methods of dry storage. These estimates were made for facilities having storage capacities ranging from 50-1900 MTU^{2/} at each of two different types of government sites, one which has an existing hot cell for the transfer of spent fuel from shipping casks to the storage modules, and one which does not. The determination of this range of charges was necessary inasmuch as the method of FIS has not yet been selected, the selection of a specific location(s) for FIS facilities has not been initiated, and the quantity of spent fuel which may become eligible to be stored in FIS facilities has not yet been determined. The total estimated charges developed by JAI are set forth in Table 2-1; the corresponding Initial Payments and Final Payments are set forth in Tables 2-2 and 2-3.

TABLE 2-1
ESTIMATE OF THE TOTAL UNIT CHARGES FOR FIS SERVICES AT THE
INDICATED FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE AND FACILITY LOCATION^{a, b}
 (1988 Dollars)

Capacity Of FIS Facility (MTU)	Total FIS Fees (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$1,063	\$1,154	\$1,084	\$ 605	\$ 817	\$ 745
100	616	640	608	387	471	439
300	303	286	279	226	229	223
800	204	174	179	175	153	157
1500	178	143	147	161	129	134
1900	171	134	138	158	124	128

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

^{2/}MTU stands for metric tons of uranium contained in the fuel assemblies at first introduction into the reactor. kgU represents kilograms of uranium contained in the fuel assemblies at first introduction into the reactor.
 1 MTU = 1000 kgU

TABLE 2-2
ESTIMATED INITIAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1988 Dollars)

Capacity Of FIS Facility (MTU)	Initial Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 610	\$ 670	\$ 621	\$ 274	\$ 428	\$ 379
100	361	371	350	193	249	229
300	189	168	167	133	127	127
800	134	104	110	113	89	95
1500	120	86	93	108	77	84
1900	116	80	88	107	74	82

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

TABLE 2-3
ESTIMATED FINAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1988 Dollars)

Capacity Of FIS Facility (MTU)	Final Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 453	\$ 484	\$ 463	\$ 331	\$ 389	\$ 366
100	255	269	258	194	222	210
300	114	118	112	93	102	96
800	70	70	69	62	64	62
1500	58	57	54	53	52	50
1900	55	54	50	51	50	46

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

The magnitude of the total unit charges set forth in Table 2-1 was about the same as that set forth in the 1986 report; in some instances the unit charges were slightly higher and in other instances they were slightly lower. This was because the escalation of costs was offset by the shorter period of time over which the FIS program would be in effect until its completion in 2001 and the cost savings associated therewith (the storage program in this report spanned the period from 1988 through 2001, while that in the 1986 report spanned the period from 1987 through 2001).

JAI also estimated the costs of transporting spent fuel between each of twenty reactor sites which are prospective candidates for FIS services and two sample locations for FIS facilities, one in the Eastern U.S. and one in the Western U.S. It was found that costs for shipments made under NRC and DOT regulations averaged from \$14/kgU to \$52/kgU for a FIS facility located in the Eastern U.S., and averaged from \$29/kgU to \$83/kgU for a FIS facility located in the Western U.S., depending on the mode of shipment involved. These estimates are subject to change because of uncertainties in shipping cask design, licensing and fabrication costs, and the possible impact of carrier deregulation.

In view of the limited amount of spent fuel that is expected to be received for FIS compared to the total amount of spent fuel stored at reactor locations, and the requirements of the Act that the Department recover the costs associated with the FIS program, it is recommended that the Department (i) establish fees for FIS and the method of collection thereof in the manner described in Section 6.0 of this report, (ii) accept only non-defective spent fuel assemblies and canistered consolidated fuel rods meeting specific acceptance criteria, (iii) require specific measurements and calculations to be made on the fuel and loaded casks delivered to the Department to support certifications with respect to the condition thereof, and (iv) obtain reimbursement for additional costs incurred as a result of its receiving defective fuel or shipping casks that are not delivered in full accordance with specific certifications required by the Department, in addition to the published charges for FIS services.

3.0 BASES FOR THE STUDY

The overall bases for DDE/S-0023, PNL-5231, PNL-5559, and PNL-6031 (which are subsequently referred to herein as the 1983 report, the 1984 report, the 1985 report, and the 1986 report, respectively) were reviewed and evaluated with respect to applicability for establishing charges for FIS services for the calendar year 1988. The following sections summarize the bases used for establishing the 1988 charges.

3.1 STORAGE METHODS CONSIDERED

For the purposes of this study, JAI used the same basic assumptions with respect to the methods of storage to be considered for FIS purposes that were used in the 1983, 1984, 1985 and 1986 reports:

- (1) that the FIS of spent fuel would be accomplished using dry, modular methods of storage inasmuch as these methods offer the greatest flexibility in meeting changing requirements for storage capacity, and
- (2) since the Department has yet to select the specific method of storage, this study considered storage by one design each of three classes of dry, modular methods including metal storage casks, drywells (or caissons below-grade), and concrete storage silos (or caissons above-grade).

JAI continues to recommend that the Department not make the selection of a specific method for use in FIS until the first contract(s) for FIS services is executed.

While the Department has continued to consider the possibility of using existing water basin storage facilities which may be available at government sites for FIS purposes, the feasibility and economics of the use of such facilities for FIS still have not been established. Therefore, the use of such facilities has not been considered in this study as a basis for establishing payment charges for FIS services for calendar year 1988.

3.2 QUANTITIES OF SPENT FUEL TO BE STORED

The prospective needs of utility companies for spent fuel storage are expected to amount to about 38 MTU in 1987 increasing to as much as 137B MTU in 1994, as described in the following Table 3-1^{3,4/}

^{3/}Department of Energy. September 1987. Spent Fuel Storage Requirements 1987. DOE/RL-87-11. Richland Operations Office, Richland, Washington.

^{4/}If a requirement for FIS services occurs before 1991, this requirement would be met by temporary storage at existing Department facilities.

TABLE 3-1
PROSPECTIVE SOURCES OF SPENT FUEL FOR FIS
(Cumulative)

Reactor	Cumulative Quantities (MTU)							
	1987	1988	1989	1990	1991	1992	1993	1994
St Lucie 1	15	46	46	73	102	102	131	160
Millstone 1	23	23	58	58	92	92	127	127
Palisades	0	7	7	34	34	61	61	88
Oconee 1 & 2	0	0	29	84	112	140	195	223
Oconee 3	0	0	0	0	28	56	56	84
Robinson 2	0	0	0	17	38	63	63	84
Brunswick 1	0	0	0	29	29	64	64	99
LaSalle City 1 & 2	0	0	0	26	66	106	186	226
Brunswick 2	0	0	0	0	7	7	42	77
Calvert Cliffs 1 & 2	0	0	0	0	0	2	38	74
LaCrosse	0	0	0	0	0	1	4	7
Pilgrim 1	0	0	0	0	0	0	28	28
Prairie Island 1 & 2	0	0	0	0	0	0	8	36
Byron 1 & 2	0	0	0	0	0	0	0	42
Indian Point 2	0	0	0	0	0	0	0	8
Oyster Creek 1	0	0	0	0	0	0	0	12
Fort Calhoun	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>3</u>
Total	38	76	140	321	508	694	1003	1378

However, it may be possible for many, if not all, of the utility companies which have the expected shortfall in spent fuel storage capacity to meet all or part of their additional storage needs through transshipments, rod consolidation^{5/}, installation of additional capacity at reactor sites, or combinations thereof. Moreover, the NRC may, during the determination of eligibility, find that much of the spent fuel currently forecast to exceed available on-site storage capacity will not qualify for FIS.

In view of the uncertainties associated with predicting the amount of spent fuel to be received for FIS, this study considered storage in

^{5/} Rod consolidation consists of removing fuel rods from the fuel assembly structure and placing them in a safe, close-packed array (in canisters) that occupies less space than the original fuel assembly.

facilities having the following nominal capacities for each of the storage methods considered up to the limitation of 1900 MTU as established by the Act:

(1) 50 MTU	(4) 800 MTU
(2) 100 MTU	(5) 1500 MTU
(3) 300 MTU	(6) 1900 MTU

3.3 LOCATION AND EXISTING CAPABILITIES OF FIS SITE

As in the 1983, 1984, 1985 and 1986 studies, this study continued to consider the use of two generic types of government sites -- one assumed to have existing facilities for transferring spent fuel from shipping casks to storage modules, and a second without such facilities. It was assumed that NRC licensing would apply to all FIS activities except the modification and operation of an existing transfer facility. JAI also estimated the costs involved in shipping spent fuel to sites in both the Eastern and the Western U.S. A site for FIS of spent fuel probably will not be specified until there are clear indications that FIS services will be required.

JAI reviewed the prospect of locating FIS facilities at reactors, as permitted by Sec. 135(a)(1)(B) and (C) of the Act, but concluded that the Department probably could not develop storage capability at such locations sooner than utility companies acting on their own. For these and the other reasons set forth in the 1983, 1984, 1985 and 1986 reports, the possibility of locating FIS facilities at reactors was not considered further in this study.

3.4 SCHEDULE OF CONSTRUCTION AND OPERATION

For the purposes of factoring the time value of money into the fee calculations of this study, JAI assumed the following concerning the schedule of constructing and operating FIS facilities in developing the revenue/expenditure schedules:

- (1) Design, licensing (as applicable) and construction of FIS facilities would commence in 1988 and be completed so that storage operations could commence in mid-1991.
- (2) The FIS facility would receive spent fuel during the three-year period between mid-1991 and mid-1994. It would ship spent fuel to a Monitored Retrievable Storage (MRS) facility or waste repository during the three-year period commencing at the beginning of 1998 and terminating at the end of 2000. One

third of the storage capacity of the FIS facility would be received each year during the receiving period, and one-third would be shipped each year during the shipping period.

- (3) Decontamination and decommissioning of FIS facilities would be conducted in the year 2001.

This schedule represents a one-year compression of the FIS program over that used in the 1986 report (and a four-year schedule compression over that of the 1983 report) inasmuch as the program has been assumed to start one year later, but ends at the same time as was assumed before.

3.5 DEVELOPMENT OF THE FEE FOR FIS

The same basic assumptions concerning the development of charges for FIS of spent fuel were used by JAI in this study as were used in the development of the 1986 report, as follows:

- (1) The charges for FIS would include the cost of
 - (a) design, licensing and construction of FIS facilities,
 - (b) storage modules,
 - (c) research and development solely related to the development of FIS facilities,
 - (d) operating costs which are incremental to the operation of the government site(s) at which the FIS facilities are located,
 - (e) government administration associated with FIS of spent fuel, including storage fund management,
 - (f) impact aid, and
 - (g) decontamination and decommissioning of the FIS facilities at the end of their useful life.
- (2) The charges for transport of spent fuel from the reactor locations to the FIS facilities would be separately included inasmuch as they would be specific to each point of origin and destination, and would be charged directly to the utility.
- (3) The fee developed for FIS of spent fuel would cover all costs of the FIS system for storage as aforementioned through the year 2000 and for the decommissioning period.

3.6 CONSOLIDATED SPENT FUEL

For this study JAI continued to assume that canistered consolidated spent fuel rods would be acceptable for storage at the FIS facilities, but that consolidation would not be a criterion for acceptance, nor would the disassembly and consolidation of spent fuel be included in the capabilities of the FIS facilities. It would be expected that the Department would collect the same fee for storage of canistered consolidated spent fuel rods as for intact fuel assemblies until the cost effects of storing consolidated fuel become known. However, the cost of transporting consolidated spent fuel rods from the reactors to FIS facilities is expected to be about 0.6 of that involved in transporting intact fuel assemblies and, therefore, would result in a significant reduction in costs for utilities sending consolidated spent fuel to FIS.

4.0 COSTS FOR FIS OF SPENT FUEL

4.1 REVIEW OF AND REVISIONS IN FIS FACILITY DESIGNS

In the development of the 1984 report, there were several design changes made to FIS facilities. During the course of this study a review was made of the resultant facility designs used in the 1984 report and it was concluded that no further design changes were either necessary or desirable for the development of FIS payment charges for 1988.

4.2 REVIEW OF AND REVISIONS IN 1986 FIS COST ESTIMATES

The estimates of the capital costs for transfer facilities and storage areas used in the development of the 1983 report, portions of which were modified in the 1984 report, were escalated to 1988 dollars using applicable cost indexes.

The estimates of the cost of concrete silos and drywells, and the estimates of government administration costs which were used in the development of the this report, were the same as those used for the 1983 report, escalated to 1988 dollars using applicable cost indexes. The estimate of the cost of canisters used in the development of this report were the same as those used for the 1984 report, escalated to 1988 dollars using applicable cost indexes. The estimates of cost of metal storage casks was derived from 1987 cost estimates obtained from cask design firms. For the purposes of this report, these 1987 costs were escalated to 1988 dollars.

The estimates of operating costs used in the development of the this report were were the same as those developed in the 1983 report, escalated to 1988 dollars.

The estimates of FIS development costs set forth in the 1983 report were reviewed and it was concluded that the same estimates would be applicable for use herein, escalated to 1988 dollars.

A description of the alternative facility designs, details of the associated cost estimates, and FIS system spending schedules are set forth in Exhibit A of this report.

Table 4-1 sets forth the total capital costs for the cases studied. The capital costs include (i) the cost of the transfer/encapsulation facilities, or modifications to existing hot cell facilities which can be used

for transfer/encapsulation, (ii) the cost of the storage area, and (iii) the cost of the storage modules.

TABLE 4-1
SUMMARY OF ESTIMATED CAPITAL COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1988)

Capacity Of FIS Facility (MTU)	Total Capital Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 27.6	\$ 30.6	\$ 28.1	\$ 10.1	\$18.1	\$ 15.6
100	33.1	33.9	31.8	15.7	21.4	19.3
300	54.2	46.9	46.9	36.7	34.4	34.4
800	106.1	79.1	84.3	88.6	66.6	71.8
1500	180.1	124.1	136.8	162.6	111.6	124.3
1900	222.1	149.9	166.8	204.6	137.4	154.3

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

From the capital cost data shown in Table 4-1, it can be seen that for the lower capacities (less than 100 MTU) the capital cost of storage cask facilities is the lowest while the drywell facilities are the highest. However, at the higher capacities (more than 300 MTU) the capital cost of drywell facilities is the lowest while the storage cask facilities are the highest. This is due to the following:

- (1) the cost of the transfer facilities is lower in the case of storage casks than for the other two cases
- (2) the cost of the storage area is lowest for the cask and highest for the drywell because of the larger size of the latter

- (3) the cost of modules is lowest for the drywell and highest for the cask
- (4) at higher capacities, the cost advantages described in (1) and (2), above, are more than offset by the higher module cost of the storage casks.

The capital costs for all cases are obviously less where an existing facility exists which can be modified for transfer/encapsulation purposes. However, cask storage requires considerably less modification to an existing facility (hot cell) than the other modes of storage since no encapsulation facilities are required.

Table 4-2 sets forth the total operating costs for the cases studied.

TABLE 4-2
SUMMARY OF ESTIMATED TOTAL OPERATING COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1988)

Capacity Of FIS Facility (MTU)	Total Operating Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 22.8	\$ 24.5	\$ 23.3	\$ 15.9	\$19.0	\$ 17.8
100	24.4	26.0	24.8	17.5	20.5	19.3
300	30.7	32.0	30.1	23.8	26.5	24.6
800	47.4	47.5	46.5	40.1	41.9	40.2
1500	72.0	71.4	66.5	63.9	64.6	59.7
1900	86.0	85.1	78.0	77.3	77.6	70.8

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

From the operating costs shown in Table 4-2, it can be seen that the operating costs associated with storage casks are the lowest for the lower capacity facilities (100 MTU and less), while those associated with the silos are the lowest for the higher capacity facilities (800 MTU and more). Operating costs at the site with an existing transfer facility are lower than those at a site where a complete transfer facility has to be built, inasmuch as in the latter case it was assumed that a small caretaker operation would be required for the new facility, whereas in the former case it was assumed that the existing facility would either find other use during the storage-only period or otherwise would have incurred caretaker expense in the absence of the FIS facility located at the site.

Table 4-3 sets forth the total costs of special charges which are applicable to each of the cases studied. These include (i) research and development costs associated with the development of the FIS facilities, (ii) government administration costs for the FIS program including storage fund management, and (iii) impact aid.

TABLE 4-3
SUMMARY OF ESTIMATED SPECIAL COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1988)

Capacity Of FIS Facility (MTU)	Total Special Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 6.2	\$ 6.2	\$ 6.2	\$ 6.2	\$ 6.2	\$ 6.2
100	8.2	8.2	8.2	8.2	8.2	8.2
300	12.8	12.8	12.8	12.8	12.8	12.8
800	23.1	23.1	23.1	23.1	23.1	23.1
1500	36.6	35.1	35.1	36.6	32.1	33.6
1900	44.1	40.3	40.3	44.1	38.4	38.4

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

From Table 4-3 it can be seen that special costs remain the same at a given capacity for all modes of storage through the 800 MTU capacity level. This is due to the fact that the FIS development costs are the same for all cases, the government administration costs are the same at each capacity level, and the impact aid is fixed at \$15/kg U. The Act establishes a maximum for impact aid amounting to \$15/kg U or 10% of all costs, whichever is smaller. In the capacity cases through 800 MTU, 10% of the costs is higher than \$15/kg U, thus \$15/kg U was used in these cases. However, in some of the cases above the 800 MTU capacity level, 10% of the costs is lower than \$15/kg U and was used, thus producing a variation among the cases considered at these capacity levels.

Table 4-4 sets forth the total discounted costs of construction and operation of the FIS storage system for each of the cases studied. These costs include the sum of all capital costs, operating costs and special costs (except impact aid) -- discounted to 1988 at 2 percent/year.

TABLE 4-4
SUMMARY OF TOTAL DISCOUNTED COSTS FOR CONSTRUCTION AND OPERATIONS
OF FIS FACILITIES HAVING DIFFERENT TOTAL STORAGE CAPACITIES^{a,b}
(\$-millions, 1988)

Capacity Of FIS Facility (MTU)	Total Discounted Costs (Discounted @ 2%/yr to 1988)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 50.5	\$ 54.9	\$ 51.5	\$ 28.1	\$38.5	\$ 35.0
100	58.0	60.3	57.2	35.6	43.8	40.7
300	83.7	78.5	76.8	61.3	62.0	60.3
800	147.1	123.3	127.0	124.4	106.7	109.8
1500	237.4	187.0	194.1	213.9	169.4	176.4
1900	288.4	223.2	232.2	264.5	205.0	214.2

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

^bDoes not include impact aid.

From the total discounted costs shown in Table 4-4, it can be seen that for the lower capacities (50-100 MTU and less) the cost of storage in storage casks is less than the other two cases, with the cost of storage in drywells being the highest. However, for the higher capacities (800 MTU and more), the cost of storage in drywells is less than the other two cases, with the cost of storage in storage casks being the highest. The cost of storage for all modes of storage are close to each other in the 100-300 MTU capacity range. The aforementioned relationships apply to both cases where transfer facilities exist at the FIS site and where they do not so exist, however, the total costs for storage by all storage methods are lower in the former case than they are in the latter.

5.0 COSTS FOR SPENT FUEL TRANSPORT

Estimates were made of the cost of transporting spent fuel from each of the prospective reactor locations identified in Table 3-1 of this report and FIS facility sites in the Eastern U.S. and the Western U.S. Estimated costs were developed for both truck transport and for rail transport, however, rail shipments should be used to the maximum extent feasible inasmuch as the larger payload of the rail casks significantly reduces the number of shipments and the amount of cask handling at both the reactor site and the FIS facilities.

Table 5-1 sets forth the estimated total cost of a single shipment of spent fuel between the various points of origin and destination considered in this study.

TABLE 5-1
SUMMARY OF ESTIMATED COSTS FOR A SINGLE CASK SHIPMENT OF SPENT
FUEL FROM SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES
(1988 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment</u>	
	<u>Truck Shipments^a</u>	<u>Rail Shipments^b</u>
<u>From Palisades to</u>		
Eastern U.S. Site	\$ 9,949	\$ 93,812
Western U.S. Site	20,509	169,487
<u>From St. Lucie to</u>		
Eastern U.S. Site	11,906	125,482
Western U.S. Site	31,077	218,390
<u>From Robinson to</u>		
Eastern U.S. Site	7,452	73,340
Western U.S. Site	30,984	188,038
<u>From Brunswick to</u>		
Eastern U.S. Site	9,180	83,443
Western U.S. Site	30,356	197,953
<u>From LaSalle to</u>		
Eastern U.S. Site	9,213	87,922
Western U.S. Site	18,107	160,724
<u>From Oconee to</u>		
Eastern U.S. Site	6,383	95,725
Western U.S. Site	26,967	192,136
<u>From Pilgrim to</u>		
Eastern U.S. Site	12,751	151,582
Western U.S. Site	29,336	213,897
<u>From Indian Point to</u>		
Eastern U.S. Site	14,338	128,922
Western U.S. Site	28,401	204,698
<u>From Millstone to</u>		
Eastern U.S. Site	12,278	138,490
Western U.S. Site	28,799	210,577

TABLE 5-1 (Continued)
SUMMARY OF ESTIMATED COSTS FOR A SINGLE CASK SHIPMENT OF SPENT
FUEL FROM SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES
 (1988 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment</u>	
	<u>Truck Shipments^a</u>	<u>Rail Shipments^b</u>
<u>From Prairie Island to</u>		
Eastern U.S. Site	\$13,821	\$126,667
Western U.S. Site	18,418	143,808
<u>From LaCrosse to</u>		
Eastern U.S. Site	12,224	117,316
Western U.S. Site	16,930	147,114
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	9,423	107,851
Western U.S. Site	26,901	205,220
<u>From Oyster Creek to</u>		
Eastern U.S. Site	10,960	122,383
Western U.S. Site	28,051	208,056
<u>From Byron to</u>		
Eastern U.S. Site	9,549	100,033
Western U.S. Site	17,382	154,152
<u>From Ft. Calhoun to</u>		
Eastern U.S. Site	13,161	166,468
Western U.S. Site	13,275	171,709

^aBased on use of NLI 1/2 truck cask with capacity for either one PWR or two BWR fuel assemblies.

^bBased on use of IF-300 rail cask with capacity for either 7 PWR or 18 BWR fuel assemblies.

6.0 FEE METHODOLOGY AND FEE COMPUTATION

6.1 METHOD OF FEE COLLECTION

JAI has reviewed the proposed method of fee collection set forth in the 1983, 1984, 1985 and 1986 reports and the alternative methods that were considered therein, and has concluded that the combined interests of the Department and the FIS users would still be best served by a two-part fee involving an Initial Payment upon execution of a contract for FIS services, followed by a Final Payment upon delivery of the spent fuel to the Department.

The Initial Payment represents an advance payment to cover the pro rata share of preoperational costs, including:

- o the capital costs of the required transfer facilities and storage area
- o module costs (i.e., storage casks, drywells, or silos)
- o development costs
- o government administrative costs including storage fund management
- o impact aid payments made in accordance with section 136(e) of the Act, and
- o interest on any Treasury funds advanced to the FIS program.

The Final Payment would cover the sum of the following:

- o any under- or over-estimation in the costs used to calculate the Initial Payment of the fee (including savings due to rod consolidation)
- o transportation costs (including cask lease, freight, handling and security)*, and
- o the total estimated cost of operation and decommissioning of the FIS facilities (including government administrative costs, storage fund management and impact aid)

*This cost is not included in the FIS payment charges schedule which is issued annually by DOE.

The Initial Payment received from all users would be calculated to provide the funds necessary to design, license (where applicable) and construct the FIS facilities, purchase storage modules, and repay any funds borrowed from the U.S. Treasury that may have been needed earlier. The Final Payments received would also include an adjustment for differences between the actual preoperational costs and those used to calculate the Initial Payment, and the estimated future costs of facility operation and decommissioning.

6.2 METHOD OF COMPUTATION OF FEE

The same method for computation of the fees for FIS services as was described in the 1983, 1984, 1985 and 1986 reports was used in this study. This method is summarized below:

- (1) In order to effect the recovery of costs incurred by the Department in providing FIS services, the fees for such services must be established such that the sum of the discounted costs of providing the services is equal to the sum of the discounted revenues received by the Department for such services, as follows:

$$\text{Discounted Costs} = \text{Discounted Revenues}$$

$$\text{Discounted Revenues} = \text{Discounted (Unit Fee} \times \text{Units of Storage)}$$

$$\text{Discounted (Unit Fee} \times \text{Units of Storage)} = \\ \text{Unit Fee} \times \text{Discounted Units of Storage}$$

- (2) Since the fee is an unknown in the above equations, but the units of storage (MTU or numbers of modules) and estimated costs are known, the fee can be calculated by the following:

$$\text{Unit Fee} = \frac{\text{Discounted Costs}}{\text{Discounted Units of Storage}}$$

- (3) Since it has been determined that a two-part fee for FIS services is desirable, and since a two-part fee would provide all required funds for the FIS of spent fuel either in advance of or at the same time that the corresponding component of cost of storage would be incurred, it is necessary to employ a discount rate equal to the "real" value of money, i.e., the value of money to the government net of escalation. The discount factor established by JAI for this purpose is 1.02 (or a 2%/year discount rate).

Using the costs developed in Exhibit A, Section 9.0, the Initial Payments, Final Payments and total payments estimated to be required in 1988 dollars for the FIS of spent fuel are set forth in Tables 6-1, 6-2 and 6-3, respectively -- for each of the three methods of storage, at the six different levels of capacity, and the two different types of locations considered in this study. The costs of transport of the spent fuel from the various prospective reactor locations to two typical FIS facility locations have been excluded from the unit costs set forth in these tables but have been shown separately in Table 6-4.

TABLE 6-1
ESTIMATED INITIAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1988 Dollars)

Capacity Of FIS Facility (MTU)	Initial Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 610	\$ 670	\$ 621	\$ 274	\$ 428	\$ 379
100	361	371	350	193	249	229
300	189	168	167	133	127	127
800	134	104	110	113	89	95
1500	120	86	93	108	77	84
1900	116	80	88	107	74	82

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

TABLE 6-2
ESTIMATED FINAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1988 Dollars)

Capacity Of FIS Facility (MTU)	Final Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 453	\$ 484	\$ 463	\$ 331	\$ 389	\$ 366
100	255	269	258	194	222	210
300	114	118	112	93	102	96
800	70	70	69	62	64	62
1500	58	57	54	53	52	50
1900	55	54	50	51	50	46

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

TABLE 6-3
ESTIMATED TOTAL UNIT COST FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1988 Dollars)

Capacity Of FIS Facility (MTU)	Total FIS Fees (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$1,063	\$1,154	\$1,084	\$ 605	\$ 817	\$ 745
100	616	640	608	387	471	439
300	303	286	279	226	229	223
800	204	174	179	175	153	157
1500	178	143	147	161	129	134
1900	171	134	138	158	124	128

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

TABLE 6-4
SUMMARY OF ESTIMATED UNIT COSTS FOR TRANSPORTING SPENT FUEL FROM
SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES^a

(1988 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment (\$/kgU)</u>	
	<u>By Truck^b</u>	<u>By Rail^c</u>
<u>From Palisades to</u>		
Eastern U.S. Site	\$21.58	\$29.07
Western U.S. Site	44.49	52.52
<u>From St. Lucie to</u>		
Eastern U.S. Site	25.83	38.88
Western U.S. Site	67.41	67.68
<u>From Robinson to</u>		
Eastern U.S. Site	16.16	22.73
Western U.S. Site	67.21	58.27
<u>From Brunswick to</u>		
Eastern U.S. Site	25.08	25.33
Western U.S. Site	82.94	60.10
<u>From LaSalle to</u>		
Eastern U.S. Site	25.17	26.69
Western U.S. Site	49.47	48.79
<u>From Oconee to</u>		
Eastern U.S. Site	13.85	29.66
Western U.S. Site	58.50	59.54
<u>From Pilgrim to</u>		
Eastern U.S. Site	34.34	46.02
Western U.S. Site	80.15	64.94
<u>From Indian Point to</u>		
Eastern U.S. Site	31.10	39.95
Western U.S. Site	61.61	63.43
<u>From Millstone to</u>		
Eastern U.S. Site	26.63	42.92
Western U.S. Site	62.47	65.26

TABLE 6-4 (Continued)
SUMMARY OF ESTIMATED UNIT COSTS FOR TRANSPORTING SPENT FUEL FROM
SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES^a
(1988 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment (\$/kgU)</u>	
	<u>By Truck^b</u>	<u>By Rail^c</u>
<u>From Prairie Island to</u>		
Eastern U.S. Site	\$29.98	\$39.25
Western U.S. Site	39.95	44.56
<u>From La Crosse to</u>		
Eastern U.S. Site	33.40	35.62
Western U.S. Site	46.26	44.66
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	20.44	33.42
Western U.S. Site	58.35	63.60
<u>From Oyster Creek to</u>		
Eastern U.S. Site	29.95	37.15
Western U.S. Site	76.64	63.16
<u>From Byron to</u>		
Eastern U.S. Site	20.71	31.00
Western U.S. Site	37.70	47.77
<u>From Ft. Calhoun to</u>		
Eastern U.S. Site	28.55	51.59
Western U.S. Site	28.80	53.21

^aBased on 0.461 MTU/PWR assembly and 0.183 MTU/BWR assembly, as introduced into the reactor. Unit cost will increase or decrease proportionately to corresponding decreases or increases in the uranium content of the fuel assemblies.

^bBased on use of NL1 1/2 truck cask with capacity for either one PWR or two BWR fuel assemblies.

^cBased on use of 1F-300 rail cask with capacity for either 7 PWR or 18 BWR fuel assemblies.

6.3 SENSITIVITY OF FEES TO CHANGES IN CONDITIONS

The sensitivity of the total fees^{6/} for FIS to changing conditions of cost, schedule, mix of spent fuel types, and discount rate, and to whether or not the facility was subject to NRC licensing, was determined for the drywell cases at storage capacity levels of 100 MTU and 1900 MTU (see Section 10.0 of Exhibit A). The results of these fee sensitivity studies are summarized below:

- (1) A change of \$1-million in the capital cost of transfer facilities at the FIS site causes a corresponding change in the total fees for FIS of about \$12/kgU at the 100 MTU capacity level, decreasing to about \$1/kgU at the 1900 MTU capacity level.
- (2) A change of \$1,000 in the cost of canisters or drywells causes a corresponding change in the total fees for FIS of about \$3/kgU at all capacity levels.
- (3) For each year the term of the FIS program is extended (due to delay in repository startup), there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$16/kgU for instances where a new transfer facility is built, and about \$10/kgU for instances where an existing transfer facility can be utilized for FIS. These increases amount to about \$2/kgU and \$1/kgU, respectively, at the 1900 MTU capacity level.
- (4) For each year the time over which spent fuel is received for storage increases, there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$2/kgU for instances where a new transfer facility is built, and about \$8/kgU for instances where an existing transfer facility can be utilized for FIS. There is little impact of the receipt schedule on total fees at the 1900 MTU capacity level.
- (5) For each year the time for design, licensing, and construction of the initial FIS facilities decreases (and thereby correspondingly increasing the amount of time spent fuel is stored), there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$20/kgU for instances where a new transfer facility is built, and about \$12/kgU for instances where an existing transfer facility can be utilized. These increases amount to about \$2.5/kgU and \$1.5/kgU, respectively, at the 1900 MTU capacity level.

^{6/} The term "total fees" used in this section refers to the sum of the Initial and Final Payments.

- (6) A one kilogram decrease in the average amount of uranium contained in the spent fuel in a drywell from the 429 kgU loading assumed for this study causes an increase in the total fees for FIS by about \$0.20/kgU, in the range of 366 kg U to 461 kg U. Conversely, a one kilogram increase in the average amount of uranium contained in a drywell causes a decrease of \$0.20/kgU in the total fees for FIS.
- (7) An increase in the discount rate by one percentage point causes a decrease in the total fees for FIS at the 100 MTU capacity level of about \$17/kgU for instances where a new transfer facility is built, and about \$13/kgU for instances where an existing transfer facility can be utilized for FIS. These decreases amount to about \$4.5/kgU for cases at the 1900 MTU capacity level.
- (8) Not having to follow the procedural (not safety) requirements involved in NRC licensing activities nor conform the FIS systems to NRC security requirements causes a decrease in the total fees for FIS by about \$95/kgU at the 100 MTU capacity level decreasing to about \$6/kgU at the 1900 MTU capacity level.

6.4 ESTABLISHMENT OF FEES FOR FIS SERVICES

JAI recommends that the Department establish its fee for FIS services in the same basic manner as it did in the 1983, 1984, 1985 and 1986 reports, and which is described below:

- (1) The fee should be published in two parts -- an Initial Payment and a Final Payment. The Final Payment should be subdivided into two components: one should include all cost components except transportation of spent fuel, and the other should include spent fuel transportation and associated costs between reactor locations and FIS facilities.
- (2) Upon publication, the Initial Payment, and the Final Payment for all cost components except transportation, should be firm until revised by a subsequent publication. The Department should plan to invoice the individual user for the actual cost the Department incurs in the transportation of the user's spent fuel to the FIS facilities.
- (3) Until the Department has received commitments for FIS services, it should publish a fee schedule for a range of capacities from 100 MTU to the 1900 MTU limit established by the Act.
- (4) Until the Department determines the location or locations for FIS facilities and the method or methods of storage to be used, the fee that represents the highest cost(s) for the combin-

ation of types of location(s) and storage method(s) under consideration should apply.

- (5) Upon execution of the first contract(s) the Department should commence the design of the FIS facilities on the basis of the contractual commitments that then exist for FIS services. These facilities should have the capacity for storage of only that amount of spent fuel which is committed to storage under the then-existing contracts.
- (6) These first contract(s) should determine the fee for FIS services from the schedule of fees published in the Federal Register. The Initial Payment should be the unit price in effect for the total storage capacity required by such contract(s) or for 100 MTU, whichever is larger. This same Initial Payment should then be charged to all subsequent users of FIS services until the Initial Payment is next revised.
- (7) The Department should revise its fee (both the Initial and Final Payment) annually to reflect (among other things) the economies of a larger FIS operation which results from additional commitments for FIS services.
- (8) Upon completion of the preoperational activities (i.e., design, safety reviews, construction, and associated activities), the Department should determine the total costs incurred -- and should credit or debit the Final Payment of each user with the difference between the amounts paid as Initial Payments and its pro rata share of the total preoperational costs (net of its pro rata share of interest earned on advance payments made).
- (9) After decommissioning of the FIS system, or December 31, 2001, whichever is later, the Department should determine the total costs incurred in design, construction, operation and decommissioning of the FIS system through December 31, 2001 -- and should make final adjustments to the extent that there is a difference between the amounts paid by each user in Initial and Final Payments and the user's pro rata share of the aforementioned costs (net of its pro rata share of interest earned on advance payments made).

The Department should plan to sign contracts for FIS services with users within 60 days after the user's need has been certified by NRC. This is necessary in order for the Department to be able to provide the required storage facilities on a timely basis.

7.0 SPENT FUEL ACCEPTANCE CRITERIA FOR FIS

In developing revised spent fuel acceptance criteria, JAI continued to be mindful of the facts that FIS was intended for use only in special situations and that only a limited amount of spent fuel would be eligible for FIS. This is in marked contrast to the repository program, which can be expected to receive all spent fuel for disposal purposes, absent any reprocessing in the U.S. Therefore, in order to simplify the FIS program and minimize the costs attendant therewith, it was concluded that the interests of the prospective users of FIS services were best served by the Department accepting only non-defective fuel assemblies and canistered consolidated fuel rods meeting specific and clearly defined acceptance criteria.

JAI has reviewed the spent fuel acceptance criteria which was included in the 1984 report and has found no basis to make any further changes thereto at the present time. For the convenience of the reader, the acceptance criteria contained in the 1984, 1985 and 1986 reports has been included in Exhibit C to this report.

EXHIBIT A

DESIGN DESCRIPTION AND ESTIMATED COSTS FOR THE DRY STORAGE
OF SPENT NUCLEAR FUEL IN FEDERAL INTERIM STORAGE FACILITIES

EXHIBIT A
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10.5 Impact of NRC Licensing Status	A10-33

EXHIBIT A
DESIGN DESCRIPTION AND ESTIMATED COSTS FOR THE DRY STORAGE
OF SPENT NUCLEAR FUEL IN FEDERAL INTERIM STORAGE FACILITIES

This Exhibit describes the design of the components of the alternative FIS systems considered, including (i) canisters, (ii) required new facilities for the transfer of spent fuel from shipping casks to either transfer casks or storage modules and for performing the encapsulation of spent fuel in cases where such is considered necessary, (iii) modifications to existing facilities at government sites which are necessary to perform the same operations as described in (ii) above, (iv) storage modules, and (v) storage facilities. The results of estimates of the capital cost of the components of the alternative FIS systems are presented as are the cost of operation thereof, and the special costs stipulated by the Act to be included in the development of charges for FIS services. A summary of the total and discounted costs of operation of the FIS system, and the unit costs resulting therefrom, is presented for each combination of storage method, capacity, and facility location which was considered (as described in Section 3.0 of the report).

In addition to the foregoing, sensitivity analyses were performed to determine the effects of changing conditions of cost, schedule, mix of fuel type, discount rate, and licensing-related activities on the unit cost for FIS.

1.0 SPENT FUEL CANISTERS

JAI considered both the need for canistering spent reactor fuel assemblies and the type of canister that should be employed. It was concluded that spent fuel assemblies that were destined for storage in sealed drywells or silos should be encapsulated to provide a double containment for the fuel assemblies. Since the metal storage casks are designed with a double containment lid, no canistering of the fuel assemblies was considered necessary for this mode of storage. It was also concluded that a carbon steel canister with convex ends would perform satisfactorily in the dry storage environment.

1.1 DESCRIPTION

The canister designed to contain one PWR or two BWR fuel assemblies has a 13-in. inside diameter and a 1/2-in. wall thickness. Canisters are prefabricated from 1/2-in. thick steel plate with a convex bottom and lid. The guide cages used to position the fuel within the canister are fabricated from 1/8-in. steel plate with 1/4-in. steel plate cage guides. A 1/2-in. steel plate is located at the bottom of the canister to support the cage and fuel. The mating surfaces of the lid and wall are machined for welding. Guides are welded inside the lid to assure positive alignment and to facilitate guiding the lid into place. A grapple pintle on the top of the lid is used to lift the lid and place it on the canister; it is also used to apply pressure during welding to assure positive contact, and to lift the loaded canisters. A vent hole through the pintle and lid is provided to relieve any pressure build-up during girth-welding, and to permit pressure and leak testing of the loaded canister; it is seal welded upon completion of such testing. It can also be used to add an inert atmosphere to the canister if desired for heat transfer or for additional corrosion protection. A TIG or MIG weld of the girth and the pintle seal welds is used to eliminate the need for a flux and subsequent chipping of slag, and the attendant generation of scrap.

Empty canisters and lids are moved from storage into the hot cell and lifted using a magnetic grapple. The empty canisters are stored in special racks and the lids are placed on a conveyor that feeds the welding machine. The loaded and tested canisters are placed in interim storage in a small vault in new hot cell facilities or are stored in a shielded storage cask in existing hot cell facilities. The canisters are subsequently loaded into a transfer cask for transfer to drywell storage or are loaded directly into a concrete silo.

1.2 ESTIMATED COST

The cost of canisters for PWR and BWR fuel assemblies to be stored in drywells or silos was estimated to average \$4,794 (1988 dollars).

2.0 RECEIVING AND HANDLING FACILITIES

Three types of receiving and handling facilities were considered for the FIS facilities. At government facilities which have no hot cell facilities which can be used for the transfer of spent fuel from shipping casks into storage casks, such will have to be provided. In the case of drywell or silo storage, these transfer facilities will also have to be equipped for encapsulation of the fuel assemblies. (Encapsulation is not necessary for cask storage because the cask provides the desired double containment of the spent fuel.) Both the transfer-only and transfer/encapsulation facilities should be equipped with a limited amount of lag storage space.

At government facilities which have hot cell facilities which could be used for the above described purposes, some modifications and equipment additions are assumed to be necessary in order to perform the described activities.

This section describes the conceptual designs of the new transfer and transfer/encapsulation facilities, and the required additions and modifications to an existing one -- and provides an estimate of the capital costs associated with such facilities.

2.1 FACILITIES FOR RECEIVING AND TRANSFER

A basic design for a transfer facility was developed and is shown in Figures A2-1, A2-2 and A2-3. This facility is a simple hot-cell facility equipped with standard hot cell equipment, and is designed to accomplish the following operations:

- (1) receive, inspect and washdown and/or decontaminate the shipping casks and storage casks
- (2) remove the cask heads from the casks and temporarily store them
- (3) remove the spent fuel from the shipping cask and place it in the storage cask
- (4) place the cask head on the storage cask when loaded, seal, and transfer the cask to the storage area
- (5) place the cask head on the empty shipping cask and prepare cask for return shipment

FIGURE A2-1
PLAN VIEW OF TRANSFER FACILITY
 Section View AA

- 1 CANISTER WELD
- 2 NDT WELD
- 3 RAD SURVEY
- 4 DECONTAMINATION STATION

A2-3

FIGURE A2-2
SIDE VIEW OF TRANSFER FACILITY
Section View BB

FIGURE A2-3
END VIEW OF TRANSFER FACILITY
 Section View CC

- (6) provide a small amount of lag storage in the hot cell to minimize shipping cask turnaround time, and for general operational convenience.

It is recognized that there have been a number of unique conceptual designs developed for accomplishing these types of transfer operations at low estimated capital cost. However, the development of these designs has not proceeded to the point that the Department should risk the use of them from either a cost or licensing standpoint, in the establishing of charges for FIS services at the present time.

Spent fuel shipping casks are received at the FIS facility on special rail cars for the IF-300 cask and on tractor-trailer trucks for the NLI 1/2 cask. The rail transport vehicle is spotted on a rail siding, extending into the concrete pad in front of the FIS transfer facility; the trucks are also spotted on this same pad. The mobile transporter straddles the rail car or truck and engages the trunions of the cask after the personnel barriers, tie-downs and impact limiters are removed. The casks are lifted horizontally to clear the carrier vehicle and moved to a clear space on the concrete pad. The casks are then rotated to a vertical position using a small hoist. They are then positioned over the dolly and lowered onto it. Tie-downs to attach the cask to the dolly are secured and the trunions disengaged. The mobile transporter is moved into the clear to be available for other work including transport of storage casks, transfer casks or silos to the storage area. The dolly and cask is moved into the washdown/decontamination area for final inspection, removal of the outer head and inner head bolts, attachment of the inner head lifting sling and installation of the expandable seal ring, gasket protection, and contamination bib. The dolly and cask are then ready to be moved into the air lock (cask unloading) area.

The transfer facility described in Figures A2-1, A2-2 and A2-3 is a reinforced concrete structure having overall dimensions of 48 ft. x 76 ft. by 61 ft. high. The interior of the hot cell is 22 ft. wide, 45 ft. long and 25 ft. high and contains a 40-ton bridge crane with a 10-ton auxiliary hoist on the same trolley. A clearance of 18 ft. under the crane hooks is provided for handling grapples and fuel assemblies. The crane is equipped with an inching motor for precise movement as well as an emergency drive to move the crane into the 22 ft. x 13 ft. shielded maintenance cell at one end of the hot cell.

All shielding walls are constructed of 5-ft. thick nuclear grade concrete and are lined with stainless steel plate for ease of decontamination. A 5-ft. thick concrete door can be used to shield the crane maintenance cell from the hot cell in the event spent fuel is exposed in the hot cell and a crane breakdown occurs. Cell viewing is provided through two 4-ft. square, lead-glass windows and CCTV cameras on the crane and in the cell. A master slave, heavy duty manipulator at each view-window is available for special purposes.

Lag storage is available in two small vaults below the floor level of the hot cell, each with space for 35-40 baskets in safe geometry spacing. Each vault has a 5-ft. thick concrete cover to be used in the event the hot cell needs to be entered when spent fuel is in lag storage. Each such vault is 7 ft. wide, 10 ft. long and 31 ft. deep (see Figure A2-2). Cooling is provided by drawing cell ventilation air through the fuel assemblies into a plenum in the lower part of each vault. The air is filtered and cooled in the HVAC area.

The cask loading/unloading area is an air-lock 22 ft. wide and 21 ft. long where both the shipping casks and storage casks are brought in on dollies and raised to mate with the underside of the hot cell access port for unloading and loading. An expandable seal between the top of the cask and the access port prevents cell atmosphere leakage into the air-lock area.

The two cell plugs which fill the access port between the air-lock and the hot cell are each constructed with a ring and a center plug such that they can be removed either together or individually. Only the center plug is removed when a truck cask is to be unloaded while both the plug and ring are removed for rail casks and storage casks. Special storage holes are provided in the floor of the hot cell for the cell plugs when they are removed in order to permit top surfaces of the plugs to be flush with the hot-cell floor, eliminating the need for additional head room in the cell (see Figure A2-2).

The auxiliary area is a multi-storied building with the HVAC and electrical switch gear equipment located on the top floor (see Figures A2-1 and A2-3). The second floor is used as an operating aisle and a manipulator repair shop. The bottom floor is utilized for low-level liquid and solid waste handling and processing, including catch tanks for the hot cell and decontamination areas, liquid filter and ion exchange systems, liquid waste solidification equipment and solid waste compaction equipment.

The other floors of the auxiliary area are utilized for change room facilities, health physics analytical laboratory, general plant maintenance shop, and administrative and engineering offices.

2.2 FACILITIES FOR RECEIVING, CANNING AND TRANSFER

The same basic facilities that were described for the transfer of spent fuel from shipping casks to storage casks in Section 2.1 can be used for the receipt, canning and transfer of the canned spent fuel assemblies to either silos or a transfer cask (in the case of drywell storage). However, in the latter cases, the facilities are equipped to perform the following additional activities:

- (1) load spent fuel assemblies into canisters
- (2) weld lid onto canister
- (3) backfill canister and seal
- (4) test/inspect weld integrity, and
- (5) decontaminate loaded canisters.

In these cases one of the two 7 ft. by 10 ft. by 31 ft. deep vaults shown in Figure A2-1 is utilized for new canister storage, loaded canister storage and the welding and test equipment. A special welding jig accurately positions the canisters against guide and drive rollers. New canisters and lids are moved into the cell through the air-lock to the cell port and to the weld jig or lag storage by means of an electromagnetic grapple. After the fuel assemblies are loaded into the canister, a handling tool picks up a lid from a conveyor and places it on the canister, holding it in place during welding. The TIG welder is positioned using a roller-follower to maintain weld gap distance. The canister is rotated and the welding sequence carried out. A canister grapple lifts the canister to the test jigs for weld and leak tests and radiation survey test.

Also for these cases, a part of the first floor of the auxiliary area is used as a warehouse to store the new canisters. Part of the second floor is eliminated to provide a high-bay warehouse so the canisters can be stored vertically. A small jib crane in this area with a magnetic grapple is

used to transfer the canisters to a handling cart for movement to the air-lock and into the cell. An 18 ft. high, double door provides access to this warehouse area.

2.3 MODIFICATION OF EXISTING FACILITIES

For the purposes of determining the likely cost of dry storage of spent fuel in FIS facilities at a government site which has an existing hot cell it was assumed that all of the activities described in Sections 2.1 and 2.2 could be performed in the hot cell with certain additions and modifications. It was also assumed that other existing facilities were available to washdown incoming casks to remove road dirt prior to unloading in the hot cell.

The hot cell was assumed to be 50 ft. wide, 160 ft. long and 55 ft. high. It is equipped with a 150/15-ton crane (15-ton auxiliary hoist on same trolley) with a hook height of 50 ft. It has a bridge mounted, overhead heavy duty manipulator with an elbow capacity of 5000 pounds, a manipulator capacity of 600 pounds, and a hook height of 28 ft. In addition the cell is equipped with two wall-mounted manipulators with a 28 ft. reach and a 27 ft. hook height. The cell is shielded with 7-ft. thick, reinforced concrete and has lead-glass viewing windows at two operating elevations on both sides of the cell length. The manipulators could be used in the welding operation but the hook height is insufficient for lifting spent fuel or loaded canisters to or from casks. The hot cell is supported by HVAC equipment, radiation alarms, laboratories for checking activity levels of smear samples, and radwaste processing facilities to handle decontamination solutions.

Any existing special test equipment in the hot cell would need to be removed or stored out of the way and the hot cell totally dedicated to the receiving, canning, and/or transfer of spent reactor fuel during the period that fuel is received for storage, and when it is being removed from storage. The modifications assumed to be required include the following:

- (1) installation of CCTV on the cranes, overhead manipulators and in the cell to provide close-up viewing of operations
- (2) construction of cask support structures in the cell to prevent the casks from falling from the vertical position during operations

- (3) procurement and installation of a modified metal storage cask for lag storage of loaded canisters prior to their placement in drywells or silos, and of two standard storage casks for lag storage of spent fuel unloaded from shipping casks (since radioactive material contained in the cell will need to be enclosed in shielded containers prior to introducing or removing items from the cell)
- (4) construction of racks for all cask heads including those from storage casks that will need to be used for lag storage
- (5) installation of welding and testing equipment described in Section 2.2 for the canistering of spent fuel assemblies
- (6) installation of a conveyor for canister lids and a rack for new canisters.

It was assumed the cell cranes and manipulators are usable without modification.

The handling procedure at the existing hot cell was assumed to differ from a new FIS transfer facility. The vehicles (trucks) bringing the casks to the existing hot cell are assumed to move directly into and out of the cell through shielded, air-lock doors. The cask tie-downs, personnel barriers, and impact limiters are removed. The trunnions are engaged with a yoke using the 150-ton bridge crane. The cask is lifted clear of the vehicle and rotated to a vertical position. It is then moved to a special cask holder where it is locked in place to prevent tipping during unloading or from any seismic activity. This holder also serves as a scaffold for worker access to the top of the cask to remove head bolts and attach head lifting slings. The outer head is removed and stored and the inner head bolts removed. Metal storage casks are placed in similar cask holders with their inner heads in place to shield any fuel assemblies transferred previously. The operators vacate the cell and the cell door is closed so that remote unloading can be conducted. The inner heads of the transport and storage casks are removed and the fuel is transferred from the shipping cask to the storage cask. Where fuel is to be sealed in canisters, three metal storage casks are used for surge storage; one for PWR fuel, one for BWR fuel and one for canistered assemblies. When canisters are to be moved to silos or drywells, a mobile transporter is used to bring the silo or transfer cask into the cell for loading.

It was also assumed for the purposes of this study that a separate storage area would be provided for the storage of modules at a government site having existing transfer facilities.

2.4 ESTIMATED COSTS

Estimates were made of the capital costs of new transfer and encapsulation facilities required for the FIS of spent fuel at a government site having no such facilities. A summary of these estimated costs is set forth in Table A2-1 for each of the three methods of dry storage considered.

TABLE A2-1
ESTIMATED CAPITAL COSTS OF NEW TRANSFER AND ENCAPSULATION FACILITIES
(\$000, 1988)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Site Preparation	\$ 13	\$ 13	\$ 13
Structures	7,158	7,158	7,158
Equipment	3,782	4,581	4,585
Equipment Installation (35% of equipment cost)	<u>1,324</u>	<u>1,603</u>	<u>1,605</u>
	12,277	13,355	13,361
Engineering (15%)	1,842	2,003	2,004
Licensing	<u>881</u>	<u>881</u>	<u>881</u>
	15,000	16,239	16,246
Contingency (35%)	<u>5,250</u>	<u>5,684</u>	<u>5,686</u>
Total	<u>\$20,250</u>	<u>\$21,923</u>	<u>\$21,932</u>

Estimates were also made of the cost of additions and modifications to the existing hot cell which are required to transfer and encapsulate spent fuel. A summary of these estimated costs is set forth in Table A2-2 for each of the three methods of dry storage considered.

TABLE A2-2
ESTIMATED COSTS OF ADDITIONS AND MODIFICATIONS TO AN EXISTING
HOT CELL FOR TRANSFER AND ENCAPSULATION OF SPENT FUEL
(\$000, 1988)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Equipment	\$ 965	\$ 5,079	\$ 5,082
Equipment Installation (35% of equipment cost)	<u>338</u>	<u>505^a</u>	<u>506^a</u>
	1,303	5,584	5,588
Engineering (15%)	195	838	838
Safety Review	<u>402</u>	<u>402</u>	<u>402</u>
	1,900	6,824	6,828
Contingency (35%)	<u>665</u>	<u>2,388</u>	<u>2,390</u>
Total	<u>\$ 2,565</u>	<u>\$ 9,212</u>	<u>\$ 9,218</u>

^a assumes no installation cost for metal storage casks used for lag storage

3.0 STORAGE CASKS

3.1 DESCRIPTION

The use of metal storage casks, which may or may not be licensed for transportation over the road, for the storage of spent fuel offer an attractive option in common with the drywell and silo modes, in that it permits the addition of storage capacity in small increments as increased capacity is required. The casks offer an additional advantage of providing capability for on-site transportation of spent fuel with the possible future prospect of serving as off-site shipping containers.

At the present time, several cask manufactures have metal storage cask designs; Ridihalgh, Eggers and Associates, Inc. (the REA-2023 cask)*, Transnuclear, Inc. (the TN-24 cask), GNS (the CASTOR-V cask), Nuclear Assurance Corporation, and Westinghouse. For this study, the Transnuclear, Inc. TN-24 cask was selected, as it represents the capacity and cost typical of these large storage casks. The TN-24 cask is shown in Figure A3-1. The cask weight (loaded) is 100 U.S. tons; it is 16½ ft. in length and 8 ft. in diameter. It will store either 24 PWR or 52 BWR fuel assemblies. According to design data, the cask will limit the fuel clad temperature to 375°C, at a decay heat of 1.0 kW/PWR assembly (24 kW total).

It is assumed that each cask can be procured with a mounting skid that can be moved with the cask onto a storage area pad, eliminating the need for special cradles.

3.2 ESTIMATED COST

Based upon manufacturers estimates and assuming delivery to a Western U.S. site, the 1988 cost of the metal storage cask was estimated to be \$1,100-thousand.

*This cask design is now owned by Mitsubishi.

A. Length 5030 mm	D. Cavity Diameter 1460 mm	G. Wall Thickness 240 mm
B. Diameter 2400 mm	E. Lid Thickness 270 mm	H. Shell Thickness 20 mm
C. Cavity Length 4140 mm	F. Bottom Thickness 260 mm	J. Shield Thickness 140 mm

FIGURE A3-1
TN-24 CASK FOR SPENT FUEL STORAGE

4.0 DRYWELLS

4.1 DESCRIPTION

Storage of spent fuel in drywells just below grade is an alternative method of interim storage. The drywells are placed on a grid within a fenced storage area. Each drywell, when loaded and the liner welded closed, provides a sealed, secondary containment for canistered spent fuel assemblies.

A schematic drawing of the drywell design used in this study is set forth in Figure A4-1. The drywell liner consists of a schedule 40 steel pipe which is 16 ft., 6 in. long and has an outside diameter of 16 in. A 1/2-in. thick plate is welded into the base of the pipe to form the bottom of the liner. A 1/2-in. thick transition ring is welded to the top of the 16 in. liner. The base of a concentric 5 ft. long, schedule 40 steel pipe, with a 20-in. outside diameter is then welded to the transition ring. The top of the 20-in. diameter pipe is machined to permit a seal plate of 1/2-in. thick steel to be inserted in a recess for welding. The transition ring provides a ledge to support the 48-in. long concrete shield plug. The liner is surrounded by 3 in. of grout on the sides and an 8-in. grout plug underneath. A 5-ft. diameter concrete collar, 20 in. thick surrounds the top of the liner and is tapered to 2 in. above grade level at the drywell liner to assure positive drainage of any surface water. A 1/2-in. thick steel cover is welded to the top of the liner after a canister of fuel is loaded therein and the concrete plug is in place. Each drywell will contain one canister of spent fuel. The top of the active fuel rods is 8-10 ft. below grade level with the canister in place. The surrounding earth serves as a radiation barrier as well as conductor of heat from the drywell.

4.2 ESTIMATED COST

The cost of the drywells described in Section 4.1 was estimated to be \$21,751 (1988 dollars). Therefore, the total cost of the drywell assembly, including the canisters described in Section 1.0, is estimated to be \$26,545.

5.0 CONCRETE SILOS

5.1 DESCRIPTION

Another alternative is the storage of spent fuel in concrete silos above ground. The silos are placed in rows on concrete stands within a fenced storage area. Each silo, when loaded and the liner welded closed, provides a sealed secondary containment for canistered spent fuel assemblies.

A schematic drawing of the silo design developed in this study is shown in Figure A5-1. A silo is a reinforced concrete structure 10 ft. in diameter and 23 ft. high. It has an inside cavity which is 45 in. in diameter and is lined with 1/4-in. steel that also serves as an inside form for pouring the structure. A 2-ft. high pedestal is located in the center of the cavity to support a secondary containment liner. This liner is 36 in. in diameter (outside) and has a 1/2-in. wall thickness. The bottom segment of the liner is 17 ft. long; at the top it is welded to the upper segment which is 39-in. diameter (inside) and 3 ft. long. The upper segment of the liner passes through the upper cavity of the silo structure and receives a 4-ft. long concrete plug to effect the closure of the liner cavity. After loading of the silo with canisters of spent fuel and insertion of the plug in the upper segment of the liner, a steel lid is welded on the top of the upper liner cavity to effect the double containment of the fuel. A cruciform spacer is provided for the lower liner cavity to position the canisters of spent fuel contained within. Each silo is capable of storing 4 canisters of spent fuel (4 PWR assemblies or 8 BWR assemblies). The loaded silo weighs about 125 tons.

5.2 ESTIMATED COST

The cost of the silos described in Section 5.1 was estimated to be \$103,174 (1988 dollars). Therefore, the total cost of the silo assembly, including four of the canisters described in Section 1.0, is estimated to be \$122,350.

FIGURE A5-1
 CONCRETE STORAGE SILO

6.0 STORAGE FACILITY COSTS

6.1 CASK STORAGE FACILITIES

The storage of spent fuel in storage casks requires a storage area with concrete stands to support the casks and a transporter to move the loaded cask to the storage area. Storage stands are added as required.

The storage cask area is a graded area with concrete stands 10 ft. wide and 18 ft. long made of 18-in. thick reinforced concrete and includes a 300 ft. long and 30 ft. wide paved road between the transfer facility and the storage area. Casks are brought to the storage area by a transporter. The casks, on their skids, are placed end-to-end in two parallel rows on the concrete stands which are separated 10 ft. apart. On each side of each pair of rows is a 30 ft. access driveway to permit easy access to each cask in its storage location. A 50 ft. buffer zone is provided around the perimeter of the concrete pad and is surrounded by an 8 ft. high chain link security fence topped with 3 strands of barbed wire. The bottom of the fence is anchored in concrete. A microwave security system is used to monitor the perimeter of the storage area, and the area is lighted. A security gate permits access of the transporter and inspection personnel to the storage area.

The transporter used to move the storage casks from the transfer facility to the storage area consists of a commercially available straddle crane having a 150-ton lift capacity, which is modified by the addition of a strongback and yoke. The cask is first lifted from the receiving carrier in a horizontal position and rotated to the vertical. After loading the cask with spent fuel and sealing the heads, it is lifted by the transporter, rotated to horizontal, and placed on its skid. After securing the cask to its skid, the cask/skid unit is lifted and moved to the storage area. When fully loaded, the speed of the transporter is limited to 60-100 ft. per minute. The straddle crane is mounted on dual rubber tires on all four corners and is driven by a diesel engine. It can operate on both gravel and paved roads, and can negotiate grades up to 6%. It has the capability of making a 90° turn. The wheel base, tread width and clear height are easily modified from standard equipment sizes by removing or adding structural sections to customize the unit to handle the storage casks.

6.2 DRYWELL STORAGE FACILITIES

The storage of canistered spent fuel in drywells requires a storage area, drywells, and handling equipment to transfer canisters to the drywells. This equipment includes a top loading/bottom discharge transfer cask, a plug cask, a shielded seal valve, transport vehicles, a portable welder for sealing each drywell, and a 1/2-ton hydraulic hoist to lift and move the drywell cover. Drywells are added as required.

The drywell storage area is a graded area with 6 in. of compacted gravel between the drywells which are constructed on approximately 19 ft. centers. The storage area is connected to the transfer facility by a 300 ft. long and 30 ft. wide paved road. A 50 ft. buffer zone is provided around the perimeter of the storage area and is surrounded by an 8 ft. high chain link security fence topped by 3 strands of barbed wire. The bottom of the fence is anchored in concrete. A microwave security system is used to monitor the perimeter of the storage area, and the area is lighted. A security gate permits access of the transporters and inspection personnel to the storage area.

The canisters of spent fuel are moved to the storage area in a transfer cask. This cask is a modified NFS-4 type cask with the length extended to accommodate the 188-in. long canisters and equipped with a shielded, manually operated valve on the bottom end with a mating surface to fit into the shield valve at the drywell. The top of the cask has an easily removable head with an integral electrically operated winch to raise and lower the canisters. The transfer cask head is brought into the hot cell, positioned over the canister storage rack, and a canister is grappled and lifted by the winch up to the head. The canister and head are lowered by the cell crane into the cask until the cask head mates with the cask. The head is clamped or bolted in place and the transfer cask is picked up vertically by the transporter, moved to a designated drywell, and mated with the shield valve.

Both the valve in the bottom of the transfer cask and the shield valve are opened and the spent fuel canister is lowered into the drywell. After the retraction of the cable, both of the valves are closed and the transfer cask is returned to the transfer facility. A smaller cask containing the drywell plug is then positioned over the shield valve and mated. Both the

valve in the bottom of the plug cask and the shield valve are then opened and the plug is lowered into the top of the drywell cavity. After retraction of the cable, the plug cask and the shield valve are lifted together and moved to the next empty drywell position. The cable from the plug cask is lowered to engage the pintle on the plug and the plug is withdrawn into the plug cask. Both the valve on the bottom of the plug cask and the shield valve are then closed and the plug cask is removed. The above process is then repeated.

After loading of each drywell, a steel cover is placed on the top of the drywell and is welded to the top of the drywell liner.

Two transporters are used to move the transfer casks and the plug cask/shield valve. Both consist of commercially available straddle cranes having a 60-ton lift, and which are modified with a special strongback. The speed of these transporters is limited to 130 ft. per minute. The straddle crane is mounted on single rubber tires on all four corners and is driven by a gasoline engine. It can operate on both gravel and paved roads and can negotiate grades up to 6%. It has the capability of making a 90° turn.

6.3 SILO STORAGE FACILITIES

The storage of canistered spent fuel in concrete silos requires a storage area with concrete stands to support the silos and a transporter to move the loaded silo from the transfer facility to a storage pad. Storage stands are added as required.

The silo storage area is a graded area with 6 in. of compacted gravel between the reinforced concrete silo storage stands. Each storage stand is a 16-in. thick, reinforced concrete slab 16 ft. wide by 32 ft. long which provides storage space for 2 silos. The stands are spaced 10 ft. apart in rows with a 25 ft. spacing (roadway) between each row of stands. The storage area is connected to the transfer facility by a 300 ft. long and 30 ft. wide paved road. A 50 ft. buffer zone is provided around the perimeter of the storage area and is surrounded by a 8 ft. high chain link security fence topped with 3 strands of barbed wire. The bottom of the fence is anchored in concrete. A microwave security system is used to monitor the perimeter of the storage area and the area is lighted. A security gate permits access of the transporter and inspection personnel to the storage area. A transporter similar to that described for cask storage is used to transport the loaded silos from the transfer facility to the concrete stands in the storage area.

6.4 ESTIMATED COSTS

Estimates were made of the capital cost of the storage area facilities required for the six levels of capacity considered for each dry storage method addressed in this study. A listing of these costs is set forth in Table A6-1 for government facilities which have existing transfer facilities and for those without such facilities.

TABLE A6-1
ESTIMATED INITIAL CAPITAL COSTS FOR STORAGE AREA FACILITIES^a
(\$000, 1988)

Capacity	Storage Method					
	Storage Cask		Drywell		Silo	
	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities
50 MTU	\$2,065	\$1,858	\$5,783	\$5,578	\$2,696	\$2,489
100 MTU	2,100	1,893	5,923	5,715	2,873	2,666
300 MTU	2,213	2,006	6,376	6,169	3,510	3,301
800 MTU	2,449	2,243	7,346	7,137	4,966	4,759
1500 MTU	2,760	2,553	8,593	8,386	6,926	6,718
1900 MTU	2,930	2,721	9,283	9,075	8,025	7,818

^aStorage area facilities at a site with existing transfer facilities include a security guard house; in the case of a new transfer facility the guard house was included in the cost of the transfer facility.

7.0 OPERATING COSTS FOR FIS SYSTEM

7.1 LOADING, STORAGE AND REMOVAL

Estimates were made of the cost of operation of the FIS system for spent fuel storage at the six capacity levels considered for each dry storage method addressed in this study, and for both government sites which have no existing transfer facilities and those which do.

A listing of the total annual operating costs of FIS facilities during the years in which spent fuel is being loaded into or removed therefrom is set forth in Table A7-1 for each of the cases studied. A listing of the total annual operating costs during the years in which storage-only takes place is set forth in Table A7-2 for each of the cases studied.

TABLE A7-1
ESTIMATED ANNUAL OPERATING COSTS FOR TRANSFER FACILITIES AND STORAGE FACILITIES
DURING LOADING AND REMOVAL OPERATIONS
(\$000, 1988)

Capacity	Storage Method					
	Storage Cask		Drywell		Silo	
	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities
50 MTU	\$1,746	\$1,835	\$1,917	\$1,981	\$1,827	\$1,892
100 MTU	1,817	1,908	2,047	2,111	1,938	2,002
300 MTU	2,093	2,184	2,558	2,623	2,279	2,345
800 MTU	2,911	3,000	3,959	4,024	3,497	3,562
1500 MTU	4,157	4,247	6,074	6,139	4,832	4,897
1900 MTU	4,865	4,954	7,282	7,346	5,594	5,658

TABLE A7-2
ESTIMATED ANNUAL OPERATING COSTS FOR STORAGE FACILITIES
AT GOVERNMENT SITE DURING STORAGE ONLY PERIOD
(\$000, 1988)

Capacity	Storage Method					
	Storage Cask		Drywell		Silo	
	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities
50 MTU	\$ 971	\$1,789	\$1,118	\$1,857	\$1,059	\$1,811
100 MTU	1,001	1,819	1,136	1,877	1,083	1,833
300 MTU	1,119	1,935	1,209	1,956	1,164	1,914
800 MTU	1,410	2,335	1,389	2,151	1,374	2,360
1500 MTU	1,824	3,002	1,677	2,790	1,661	2,797
1900 MTU	2,061	3,383	1,839	3,156	1,827	3,051

7.2 DECONTAMINATION AND DECOMMISSIONING

In addition to the operating costs listed in Tables A7-1 and A7-2 for the various methods of storage considered, the cost of decontamination and decommissioning of the storage facilities at the end of their useful life was estimated. These costs were assumed to amount to 20 percent of the capital cost of transfer facilities, storage area facilities and storage modules. In the case of storage at a government site which has existing transfer facilities, only the capital cost of additions and modifications to the facilities were included in the calculation inasmuch as it was reasoned that the existing facilities would otherwise have had to be decommissioned by the government in the absence of the FIS system.

8.0 OTHER ASSOCIATED STORAGE COSTS

8.1 GOVERNMENT ADMINISTRATIVE COSTS

An estimated allowance for government administrative costs associated with the FIS program was developed which assumed that the Department's administration of the program would be handled by a Program Manager assisted to the extent necessary by another program person, an accountant, and a clerical person. The following Table A8-1 sets forth the total estimated annual costs for this administrative activity including storage fund management.

TABLE A8-1
ESTIMATED ANNUAL COSTS FOR GOVERNMENT ADMINISTRATION ASSOCIATED
WITH FEDERAL INTERIM STORAGE
(\$000, 1988)

	<u>Total Capacity of FIS Facilities</u>					
	<u>50</u> <u>MTU</u>	<u>100</u> <u>MTU</u>	<u>300</u> <u>MTU</u>	<u>800</u> <u>MTU</u>	<u>1,500</u> <u>MTU</u>	<u>1,900</u> <u>MTU</u>
Annual Total	\$130	\$220	\$338	\$536	\$752	\$857

8.2 FIS DEVELOPMENT COSTS

The Act provides that the Department may establish a research and development program for the dry storage of up to 300 MTU of spent fuel at facilities owned by the government (Sec. 218(c)), that the total contributions from Federal funds shall not exceed 25 percent of the program costs (Sec. 218(d)), and that the remaining costs of such program shall be paid for by the utilities involved or shall be provided from the interim storage fund (Sec. 218(d)). For the purposes of this study, it has been assumed that all of the costs in excess of the contribution of 25 percent of the program costs from Federal funds will be borne by the utility involved in the research and development program and, therefore, none of the costs associated with the program will be included in the fee for FIS.

However, the Act provides that funds required for the development of FIS facilities may be obtained from the storage fund (Sec. 136(d)(1)) and, therefore, will have to be included in the calculation of the fee for FIS in order to allow the Department to realize recovery of costs incurred in connection with FIS activities, as provided in Sec. 136(f)(6) of the Act. It is estimated that the costs associated with the development of the FIS program will amount to about \$3.6-million and will be incurred in accordance with the following estimated schedule of expenditures:

<u>Year</u>	<u>Amount</u> <u>(\$000, 1988)</u>
1988	\$ 600 (half year)
1989	1,200
1990	1,200
1991	<u>600</u> (half year)
Total	<u><u>\$3,600</u></u>

8.3 IMPACT AID

The cost of impact aid was estimated on the following basis:

- (1) Impact aid will commence at the beginning of CY-1988 and will be terminated at the end of CY-2001.
- (2) The total impact aid will amount to the lesser of the following alternatives:
 - (a) 10% of the total cost of establishing and operating the FIS system -- including all capital, operating and decommissioning costs of the storage facilities involved, plus a pro rata share of research and development, government administration and trust fund management, but will exclude the cost of shipping.
 - (b) \$15/kgU contained in the spent fuel stored.
- (3) One-third of the total impact aid has been included in the Initial Payment, and two-thirds of the impact aid has been included in the Final Payment.

9.0 TOTAL COST OF FIS STORAGE

The total cost associated with FIS storage was computed for each combination of storage method, capacity and location which was studied using the applicable elements of cost developed in Sections 1.0 through 8.0 of this Exhibit A, and an estimated annual spending schedule (in 1988 dollars) was developed for each such case. The annual costs which were estimated to be incurred prior to the startup of the FIS system plus the annual costs of the storage modules required (the component to be included in the Initial Payment) and the annual costs which were estimated to be incurred after startup through decommissioning (the component to be included in the Final Payment) were separately discounted to 1988 at a discount rate of 2%/year.

The Initial Payments were calculated by equating the total discounted costs estimated to be incurred prior to startup of the FIS system and the discounted revenues (which are equal to the discounted quantities times a uniform unit cost) and solving the equality for the unknown value, i.e., the unit cost. Since the Initial Payment is assumed to be made in 1988 for all spent fuel to be stored, the revenues would be as follows:

<u>Capacity of FIS Storage (MTU)</u>	<u>Revenues</u>
50	\$ 50 P_1
100	100 P_1
300	300 P_1
800	800 P_1
1500	1,500 P_1
1900	1,900 P_1

where P_1 is the unit cost (or Initial Payment)

The Final Payments were similarly calculated using the discounted total costs estimated to be incurred after startup of the FIS system and the discounted revenues set forth in Table A9-1.

The estimated spending schedules, discounted annual costs and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases studied are set forth in Tables A9-2 through A9-37.

TABLE A9-1
ANNUAL AND DISCOUNTED REVENUES RECEIVED FROM FINAL PAYMENTS FOR FIS SERVICES^a

Year	Capacity											
	50 MTU		100 MTU		300 MTU		800 MTU		1500 MTU		1900 MTU	
	Rev.	Disc. To 1988 @ 2%/Yr	Rev.	Disc. To 1988 @ 2%/Yr	Rev.	Disc. To 1988 @ 2%/Yr	Rev.	Disc. To 1988 @ 2%/Yr	Rev.	Disc. To 1988 @ 2%/Yr	Rev.	Disc. To 1988 @ 2%/Yr
1991	\$ 8 P ₂	\$ 7.5 P ₂	\$ 17 P ₂	\$16.0 P ₂	\$ 50 P ₂	\$ 47.1 P ₂	\$133 P ₂	\$125.3 P ₂	\$ 250 P ₂	\$ 235.6 P ₂	\$ 317 P ₂	\$ 298.7 P ₂
1992	\$17 P ₂	15.7 P ₂	33 P ₂	30.5 P ₂	100 P ₂	92.4 P ₂	267 P ₂	246.7 P ₂	500 P ₂	461.9 P ₂	633 P ₂	584.8 P ₂
1993	17 P ₂	15.4 P ₂	33 P ₂	29.9 P ₂	100 P ₂	90.6 P ₂	267 P ₂	241.8 P ₂	500 P ₂	452.9 P ₂	633 P ₂	573.3 P ₂
1994	8 P ₂	7.1 P ₂	17 P ₂	15.1 P ₂	50 P ₂	44.4 P ₂	133 P ₂	118.1 P ₂	250 P ₂	222.0 P ₂	317 P ₂	281.5 P ₂
Total	\$50 P ₂	\$45.7 P ₂	\$100 P ₂	\$91.5 P ₂	\$300 P ₂	\$274.5 P ₂	\$800 P ₂	\$731.9 P ₂	\$1500 P ₂	\$1372.4 P ₂	\$1900 P ₂	\$1738.3 P ₂

^a Assumes revenues received in first three years after startup on a uniform basis
P₂ = Final Payment

TABLE A9-2
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3319	1025			600	130	5074	5074
1989	238	138			1200	130	1706	1673
1990	8406	382			1200	130	10118	9725
1991	8287	313	917	918	600	130	11165	10521
1992			1833	1835		130	3798	3509
1993			1833	1835		130	3798	3440
1994			917	1812		130	2859	2539
1995				1789		130	1919	1671
1996				1789		130	1919	1638
1997				1789		130	1919	1606
1998				1835		130	1965	1612
1999				1835		130	1965	1580
2000				1835		130	1965	1549
2001				5522*		130	5652	4369
TOTAL	20250	1858	3500	22794	3600	1820	55822	50506

* - DECOMMISSIONING COST

INITIAL PAYMENT = 610 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 453 \$KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-3
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 10 CASKS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3319	1030			600	220	5169	5169
1989	238	138			1200	220	1796	1761
1990	8406	397			1200	220	10223	9826
1991	8287	328	1833	954	600	220	12222	11517
1992			3667	1908		220	5795	5354
1993			3667	1908		220	5795	5249
1994			1833	1864		220	3917	3478
1995				1819		220	2039	1775
1996				1819		220	2039	1740
1997				1819		220	2039	1706
1998				1908		220	2128	1746
1999				1908		220	2128	1711
2000				1908		220	2128	1678
2001				6629*		220	6849	5295
TOTAL	20250	1893	11000	24444	3600	3080	64267	58005

* - DECOMMISSIONING COST

INITIAL PAYMENT = 361 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 255 \$KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-4

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 29 CASKS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3319	1045			600	338	5302	5302
1989	238	138			1200	338	1914	1876
1990	8406	446			1200	338	10390	9987
1991	8287	377	5317	1092	600	338	16011	15088
1992			10633	2184		338	13155	12153
1993			10633	2184		338	13155	11915
1994			5317	2060		338	7715	6851
1995				1935		338	2273	1979
1996				1935		338	2273	1940
1997				1935		338	2273	1902
1998				2184		338	2522	2069
1999				2184		338	2522	2028
2000				2184		338	2522	1989
2001				10831*		338	11169	8634
TOTAL	20250	2006	31900	30708	3600	4732	93196	83713

* - DECOMMISSIONING COST

INITIAL PAYMENT = 189 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 114 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-5

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 76 CASKS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3319	1076			600	536	5531	5531
1989	238	138			1200	536	2112	2071
1990	8406	549			1200	536	10691	10276
1991	8287	480	13933	1500	600	536	25336	23875
1992			27867	3000		536	31403	29012
1993			27867	3000		536	31403	28443
1994			13933	2668		536	17137	15217
1995				2335		536	2871	2499
1996				2335		536	2871	2450
1997				2335		536	2871	2402
1998				3000		536	3536	2901
1999				3000		536	3536	2844
2000				3000		536	3536	2788
2001				21219*		536	21755	16817
TOTAL	20250	2243	83600	47392	3600	7504	164589	147126

* - DECOMMISSIONING COST

INITIAL PAYMENT = 134 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 70 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-6

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 143 CASKS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(*000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3319	1116			600	752	5787	5787
1989	238	138			1200	752	2328	2282
1990	8406	684			1200	752	11042	10613
1991	8287	615	26217	2124	600	752	38595	36369
1992			52433	4247		752	57432	53038
1993			52433	4247		752	57432	52018
1994			26217	3625		752	30594	27167
1995				3002		752	3754	3268
1996				3002		752	3754	3204
1997				3002		752	3754	3141
1998				4247		752	4999	4101
1999				4247		752	4999	4021
2000				4247		752	4999	3942
2001				36021*		752	36773	28427
TOTAL	20250	2553	157300	72011	3600	10528	266242	237398

* - DECOMMISSIONING COST

INITIAL PAYMENT = 120 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 58 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-7

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 181 CASKS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(*000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3319	1138			600	858	5915	5915
1989	238	138			1200	858	2434	2386
1990	8406	757			1200	858	11221	10785
1991	8287	688	33183	2477	600	858	46093	43434
1992			66367	4954		858	72179	66682
1993			66367	4954		858	72179	65375
1994			33183	4169		858	38210	33929
1995				3383		858	4241	3692
1996				3383		858	4241	3620
1997				3383		858	4241	3549
1998				4954		858	5812	4763
1999				4954		858	5812	4674
2000				4954		858	5812	4583
2001				44414*		858	45272	34997
TOTAL	20250	2721	199100	85979	3600	12012	323662	288389

* - DECOMMISSIONING COST

INITIAL PAYMENT = 116 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 55 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-8

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 118 DRYWELLS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1718			600	130	5985	5985
1989	238	148			1200	130	1716	1682
1990	9134	1893			1200	130	12357	11877
1991	9015	1819	522	991	600	130	13077	12323
1992			1044	1981		130	3155	2915
1993			1044	1981		130	3155	2858
1994			522	1919		130	2571	2283
1995				1857		130	1987	1730
1996				1857		130	1987	1696
1997				1857		130	1987	1663
1998				1981		130	2111	1732
1999				1981		130	2111	1698
2000				1981		130	2111	1665
2001				6127*		130	6257	4837
TOTAL	21924	5578	3132	24513	3600	1820	60567	54944

* - DECOMMISSIONING COST

INITIAL PAYMENT = 670 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 484 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-9

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1606	1771
1990	9134	1932			1200	220	12506	12020
1991	9015	1879	1044	1056	600	220	13814	13017
1992			2088	2111		220	4419	4082
1993			2088	2111		220	4419	4002
1994			1044	1994		220	3258	2893
1995				1877		220	2097	1826
1996				1877		220	2097	1790
1997				1877		220	2097	1755
1998				2111		220	2331	1912
1999				2111		220	2331	1875
2000				2111		220	2331	1838
2001				6781*		220	7001	5412
TOTAL	21924	5715	6264	26017	3600	3080	66500	60256

* - DECOMMISSIONING COST

INITIAL PAYMENT = 371 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 269 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-10

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 707 DRYWELLS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1795			600	338	6270	6270
1989	238	148			1200	338	1924	1886
1990	9134	2150			1200	338	12822	12324
1991	9015	2076	3128	1312	600	338	16469	15519
1992			6256	2623		338	9217	8515
1993			6256	2623		338	9217	8348
1994			3128	2290		338	5756	5111
1995				1956		338	2294	1997
1996				1956		338	2294	1958
1997				1956		338	2294	1920
1998				2623		338	2961	2429
1999				2623		338	2961	2381
2000				2623		338	2961	2335
2001				9372*		338	9710	7506
TOTAL	21924	6169	18768	31557	3600	4732	87150	78459

* - DECOMMISSIONING COST

INITIAL PAYMENT = 168 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 118 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-11

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1886 DRYWELLS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1921			600	536	6594	6594
1989	238	148			1200	536	2122	2080
1990	9134	2571			1200	536	13441	12919
1991	9015	2497	8344	2012	600	536	23004	21677
1992			16688	4024		536	21248	19630
1993			16688	4024		536	21248	19245
1994			8344	3088		536	11968	10627
1995				2151		536	2687	2339
1996				2151		536	2687	2293
1997				2151		536	2687	2248
1998				4024		536	4560	3741
1999				4024		536	4560	3667
2000				4024		536	4560	3596
2001				15825*		536	16361	12648
TOTAL	21924	7137	50064	47498	3600	7504	137727	123304

* - DECOMMISSIONING COST

INITIAL PAYMENT = 104 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 70 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-12

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 3535 DRYWELLS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STDR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2084	-----	-----	600	752	6973	6973
1989	238	148			1200	752	2338	2292
1990	9134	3114			1200	752	14200	13649
1991	9015	3040	15639	3070	600	752	32116	30264
1992			31279	6139		752	38170	35263
1993			31279	6139		752	38170	34572
1994			15639	4465		752	20856	18520
1995				2790		752	3542	3084
1996				2790		752	3542	3023
1997				2790		752	3542	2964
1998				6139		752	6891	5653
1999				6139		752	6891	5542
2000				6139		752	6891	5434
2001				24829*		752	25581	19775
TOTAL	21924	8386	93836	71429	3600	10528	209703	187008

* - DECOMMISSIONING COST

INITIAL PAYMENT = 86 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 57 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A9-13

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174	-----	-----	600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	19811	3673	600	858	37297	35146
1992			39623	7346		858	47827	44185
1993			39623	7346		858	47827	43318
1994			19811	5251		858	25920	23016
1995				3156		858	4014	3494
1996				3156		858	4014	3426
1997				3156		858	4014	3359
1998				7346		858	8204	6730
1999				7346		858	8204	6598
2000				7346		858	8204	6465
2001				29973*		858	30831	23833
TOTAL	21924	9075	116868	85095	3600	12012	250574	223177

* - DECOMMISSIONING COST

INITIAL PAYMENT = 80 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 54 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A9-14

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 30 SILOS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STDR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3538	1465			600	130	5733	5733
1989	238	148			1200	130	1716	1682
1990	9138	475			1200	130	10943	10518
1991	9019	401	610	946	600	130	11706	11031
1992			1220	1892		130	3242	2995
1993			1220	1892		130	3242	2936
1994			610	1852		130	2592	2302
1995				1811		130	1941	1690
1996				1811		130	1941	1657
1997				1811		130	1941	1624
1998				1892		130	2022	1659
1999				1892		130	2022	1626
2000				1892		130	2022	1594
2001				5616*		130	5746	4442
TOTAL	21933	2489	3660	23307	3600	1820	56809	51489

* - DECOMMISSIONING COST

INITIAL PAYMENT = 621 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 463 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A9-15

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 59 SILOS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3538	1488			600	220	5846	5846
1989	238	148			1200	220	1806	1771
1990	9138	552			1200	220	11110	10679
1991	9019	478	1203	1001	600	220	12521	11799
1992			2406	2002		220	4628	4276
1993			2406	2002		220	4628	4192
1994			1203	1918		220	3341	2967
1995				1833		220	2053	1787
1996				1833		220	2053	1752
1997				1833		220	2053	1718
1998				2002		220	2222	1823
1999				2002		220	2222	1787
2000				2002		220	2222	1752
2001				6363*		220	6583	5089
TOTAL	21933	2666	7218	24791	3600	3080	63288	57238

* - DECOMMISSIONING COST

INITIAL PAYMENT = 350 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 258 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A9-16

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 177 SILOS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3538	1571			600	338	6047	6047
1989	238	148			1200	338	1924	1886
1990	9138	828			1200	338	11504	11057
1991	9019	754	3609	1173	600	338	15493	14599
1992			7217	2345		338	9900	9146
1993			7217	2345		338	9900	8567
1994			3609	2130		338	6077	5396
1995				1914		338	2252	1961
1996				1914		338	2252	1922
1997				1914		338	2252	1884
1998				2344		338	2682	2200
1999				2344		338	2682	2157
2000				2344		338	2682	2115
2001				9377*		338	9715	7510
TOTAL	21933	3301	21652	30144	3600	4732	85362	76847

* - DECOMMISSIONING COST

INITIAL PAYMENT = 167 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 112 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-17

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3538	1761			600	536	6435	6435
1989	238	148			1200	536	2122	2080
1990	9138	1462			1200	536	12336	11857
1991	9019	1388	9606	1781	600	536	22930	21607
1992			19212	3562		536	23310	21535
1993			19212	3562		536	23310	21113
1994			9606	2961		536	13103	11635
1995				2360		536	2896	2521
1996				2360		536	2896	2472
1997				2360		536	2896	2423
1998				3562		536	4098	3362
1999				3562		536	4098	3296
2000				3562		536	4098	3231
2001				16865*		536	17402	13452
TOTAL	21933	4759	57636	46498	3600	7504	141930	127015

* - DECOMMISSIONING COST

INITIAL PAYMENT = 110 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 69 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-18

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 884 SILOS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3538	2017			600	752	6907	6907
1989	238	148			1200	752	2338	2292
1990	9138	2313			1200	752	13403	12883
1991	9019	2240	18025	2449	600	752	33085	31177
1992			36051	4897		752	41700	38524
1993			36051	4897		752	41700	37759
1994			18025	3847		752	22624	20089
1995				2797		752	3549	3090
1996				2797		752	3549	3029
1997				2797		752	3549	2970
1998				4897		752	5649	4634
1999				4897		752	5649	4543
2000				4897		752	5649	4454
2001				27361*		752	28113	21732
TOTAL	21933	6718	108152	66533	3600	10528	217464	194095

* - DECOMMISSIONING COST

INITIAL PAYMENT = 93 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 54 \$/kgU (INCLUDES \$ 9/kgU IMPACT AID)

TABLE A9-19

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1120 SILOS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3538	2160			600	858	7156	7156
1989	238	148			1200	858	2444	2396
1990	9138	2792			1200	858	13988	13445
1991	9019	2718	22837	2829	600	858	38861	36620
1992			45674	5658		858	52190	48216
1993			45674	5658		858	52190	47270
1994			22837	4355		858	28050	24908
1995				3051		858	3909	3403
1996				3051		858	3909	3336
1997				3051		858	3909	3271
1998				5658		858	6516	5345
1999				5658		858	6516	5241
2000				5658		858	6516	5138
2001				33355*		858	34213	26448
TOTAL	21933	7818	137022	77982	3600	12012	260367	232193

* - DECOMMISSIONING COST

INITIAL PAYMENT = 88 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 50 \$/kgU (INCLUDES \$ 9/kgU IMPACT AID)

TABLE A9-20
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	644	1032			600	130	2426	2426
1989	109	138			1200	130	1577	1546
1990	934	472			1200	130	2736	2630
1991	880	403	917	873	600	130	3803	3584
1992			1833	1746		130	3709	3427
1993			1833	1746		130	3709	3359
1994			917	1339		130	2406	2136
1995				971		130	1101	958
1996				971		130	1101	940
1997				971		130	1101	921
1998				1746		130	1876	1539
1999				1746		130	1876	1509
2000				1746		130	1876	1479
2001				2026*		130	2156	1667
TOTAL	2567	2065	5500	15901	3600	1820	31453	28121

* - DECOMMISSIONING COST

INITIAL PAYMENT = 274 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 331 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-21
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 10 CASKS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	644	1057			600	220	2521	2521
1989	109	138			1200	220	1667	1634
1990	934	487			1200	220	2841	2731
1991	880	418	1833	909	600	220	4860	4580
1992			3667	1817		220	5704	5270
1993			3667	1817		220	5704	5166
1994			1833	1409		220	3462	3074
1995				1001		220	1221	1063
1996				1001		220	1221	1042
1997				1001		220	1221	1022
1998				1817		220	2037	1671
1999				1817		220	2037	1638
2000				1817		220	2037	1606
2001				3133*		220	3353	2592
TOTAL	2567	2100	11000	17539	3600	3080	39886	35610

* - DECOMMISSIONING COST

INITIAL PAYMENT = 193 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 194 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-22

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 29 CASKS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	644	1072			500	338	2654	2654
1989	109	138			1200	338	1785	1750
1990	934	536			1200	338	3008	2891
1991	880	467	5317	1047	500	338	8649	8150
1992			10633	2093		338	13064	12069
1993			10633	2093		338	13064	11832
1994			5317	1506		338	7261	6448
1995				1119		338	1457	1258
1996				1119		338	1457	1244
1997				1119		338	1457	1219
1998				2093		338	2431	1994
1999				2093		338	2431	1955
2000				2093		338	2431	1917
2001				7336*		338	7674	5932
TOTAL	2567	2213	31900	23811	3600	4732	58823	51323

* - DECOMMISSIONING COST

INITIAL PAYMENT = 133 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 93 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A9-23

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 76 CASKS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	644	1102			500	536	2882	2882
1989	109	138			1200	536	1983	1944
1990	934	639			1200	536	3309	3181
1991	880	570	13933	1456	500	536	17975	16938
1992			27867	2911		536	31314	28929
1993			27867	2911		536	31314	28362
1994			13933	2161		536	16630	14767
1995				1410		536	1946	1694
1996				1410		536	1946	1661
1997				1410		536	1946	1628
1998				2911		536	3447	2828
1999				2911		536	3447	2772
2000				2911		536	3447	2718
2001				17723*		536	18259	14115
TOTAL	2567	2449	83600	40125	3600	7504	139845	124419

* - DECOMMISSIONING COST

INITIAL PAYMENT = 113 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 62 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A9-24

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 143 CASKS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	644	1143			600	752	3139	3139
1989	109	138			1200	752	2199	2156
1990	934	774			1200	752	3660	3518
1991	880	705	26217	2079	600	752	31233	29432
1992			52433	4157		752	57342	52975
1993			52433	4157		752	57342	51936
1994			26217	2991		752	29960	26604
1995				1824		752	2576	2243
1996				1824		752	2576	2199
1997				1824		752	2576	2155
1998				4157		752	4909	4027
1999				4157		752	4909	3948
2000				4157		752	4909	3871
2001				32325*		752	33277	25724
TOTAL	2567	2760	157300	63852	3600	10528	240607	213927

* - DECOMMISSIONING COST

INITIAL PAYMENT = 108 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 53 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-25

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 181 CASKS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	644	1165			600	858	3267	3267
1989	109	138			1200	858	2305	2260
1990	934	848			1200	858	3840	3691
1991	880	779	33183	2433	600	858	38733	36499
1992			66367	4865		858	72090	66600
1993			66367	4865		858	72090	65294
1994			33183	3463		858	37504	33302
1995				2061		858	2919	2541
1996				2061		858	2919	2491
1997				2061		858	2919	2442
1998				4865		858	5723	4695
1999				4865		858	5723	4603
2000				4865		858	5723	4513
2001				40919*		858	41777	32295
TOTAL	2567	2930	199100	77323	3600	12012	297532	264493

* - DECOMMISSIONING COST

INITIAL PAYMENT = 107 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 51 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-26
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 118 DRYWELLS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1745			600	130	3986	3986
1989	109	148			1200	130	1587	1556
1990	3823	1982			1200	130	7135	6858
1991	3769	1908	522	959	600	130	7888	7433
1992			1044	1917		130	3091	2856
1993			1044	1917		130	3091	2800
1994			522	1518		130	2170	1927
1995				1118		130	1248	1086
1996				1118		130	1248	1065
1997				1118		130	1248	1044
1998				1917		130	2047	1679
1999				1917		130	2047	1646
2000				1917		130	2047	1614
2001				3625*		130	3755	2503
TOTAL	9212	5783	3132	19041	3600	1820	42588	38453

* - DECOMMISSIONING COST

INITIAL PAYMENT = 428 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 389 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A9-27
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1644
1990	3823	2043			1200	220	7286	7003
1991	3769	1969	1044	1024	600	220	8626	8128
1992			2088	2047		220	4355	4023
1993			2088	2047		220	4355	3944
1994			1044	1592		220	2856	2536
1995				1136		220	1356	1180
1996				1136		220	1356	1157
1997				1136		220	1356	1135
1998				2047		220	2267	1860
1999				2047		220	2267	1823
2000				2047		220	2267	1788
2001				4280*		220	4500	3479
TOTAL	9212	5923	6264	20539	3600	3060	46618	43794

* - DECOMMISSIONING COST

INITIAL PAYMENT = 249 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 222 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A9-28

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 707 DRYWELLS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1822			600	338	4271	4271
1989	109	148			1200	338	1795	1760
1990	3823	2240			1200	338	7601	7306
1991	3769	2166	3128	1275	600	338	11280	10629
1992			6256	2558		338	9152	8455
1993			6256	2558		338	9152	8289
1994			3128	1884		338	5350	4751
1995				1209		338	1547	1347
1996				1209		338	1547	1320
1997				1209		338	1547	1294
1998				2558		338	2896	2376
1999				2558		338	2896	2329
2000				2558		338	2896	2283
2001				6871*		338	7209	5573
TOTAL	9212	6376	18768	26451	3600	4732	69139	61983

* - DECOMMISSIONING COST

INITIAL PAYMENT = 127 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 102 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-29

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1886 DRYWELLS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1949			600	536	4596	4596
1989	109	148			1200	536	1993	1954
1990	3823	2661			1200	536	8220	7901
1991	3769	2588	8344	1980	600	536	17817	16789
1992			16688	3959		536	21183	19570
1993			16688	3959		536	21183	19186
1994			8344	2674		536	11554	10260
1995				1389		536	1925	1676
1996				1389		536	1925	1643
1997				1389		536	1925	1611
1998				3959		536	4495	3687
1999				3959		536	4495	3615
2000				3959		536	4495	3544
2001				13324*		536	13860	10714
TOTAL	9212	7346	30064	41940	3600	7504	119666	106746

* - DECOMMISSIONING COST

INITIAL PAYMENT = 89 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 64 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-30

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 3535 DRYWELLS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2111			600	752	4974	4974
1989	109	148			1200	752	2209	2168
1990	3823	3204			1200	752	8979	8630
1991	3769	3130	15639	3037	600	752	26927	25374
1992			31279	6074		752	38105	35203
1993			31279	6074		752	38105	34513
1994			15639	3876		752	20267	17997
1995				1677		752	2429	2115
1996				1677		752	2429	2073
1997				1677		752	2429	2032
1998				6074		752	6826	5600
1999				6074		752	6826	5490
2000				6074		752	6826	5382
2001				22329*		752	23080	17842
TOTAL	9212	8593	93836	64642	3600	10528	190411	169391

* - DECOMMISSIONING COST

INITIAL PAYMENT = 77 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 52 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A9-31

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			1200	858	2315	2270
1990	3823	3504			1200	858	9385	9021
1991	3769	3430	19811	3641	600	858	32109	30257
1992			39623	7282		858	47763	44126
1993			39623	7282		858	47763	43260
1994			19811	4561		858	25230	22404
1995				1839		858	2697	2348
1996				1839		858	2697	2302
1997				1839		858	2697	2257
1998				7282		858	8140	6678
1999				7282		858	8140	6547
2000				7282		858	8140	6418
2001				27473*		858	28331	21901
TOTAL	9212	9283	116858	77602	3600	12012	230577	204935

* - DECOMMISSIONING COST

INITIAL PAYMENT = 74 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 50 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A9-32

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 30 SILOS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1492			600	130	3733	3733
1989	109	148			1200	130	1587	1556
1990	3826	565			1200	130	5721	5499
1991	3772	491	610	914	600	130	6517	6141
1992			1220	1827		130	3177	2935
1993			1220	1827		130	3177	2878
1994			610	1443		130	2183	1938
1995				1059		130	1189	1035
1996				1059		130	1189	1015
1997				1059		130	1189	995
1998				1827		130	1957	1605
1999				1827		130	1957	1574
2000				1827		130	1957	1543
2001				3115*		130	3245	2508
TOTAL	9218	2636	3660	17784	3600	1820	38778	34955

* - DECOMMISSIONING COST

INITIAL PAYMENT = 379 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 366 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-33

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 59 SILOS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1515			600	220	3846	3846
1989	109	148			1200	220	1677	1644
1990	3826	642			1200	220	5888	5659
1991	3772	568	1203	969	600	220	7332	6909
1992			2406	1938		220	4564	4216
1993			2406	1938		220	4564	4134
1994			1203	1511		220	2934	2605
1995				1083		220	1303	1134
1996				1083		220	1303	1112
1997				1083		220	1303	1090
1998				1938		220	2158	1770
1999				1938		220	2158	1736
2000				1938		220	2158	1702
2001				3862*		220	4082	3156
TOTAL	9218	2873	7218	19281	3600	3080	45270	40713

* - DECOMMISSIONING COST

INITIAL PAYMENT = 229 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 210 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-34

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 177 SILOS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1598			600	338	4047	4047
1989	109	148			1200	338	1795	1760
1990	3826	919			1200	338	6283	6029
1991	3772	845	3609	1140	600	338	10304	9710
1992			7217	2279		338	9834	9085
1993			7217	2279		338	9834	6907
1994			3609	1722		338	5669	5034
1995				1164		338	1502	1308
1996				1164		338	1502	1282
1997				1164		338	1502	1257
1998				2278		338	2616	2146
1999				2278		338	2616	2104
2000				2278		338	2616	2063
2001				6676*		338	7214	5577
TOTAL	9218	3510	21652	24622	3600	4732	67334	60319

* - DECOMMISSIONING COST

INITIAL PAYMENT = 127 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 96 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-35

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1788			600	536	4435	4435
1989	109	148			1200	536	1993	1954
1990	3826	1552			1200	536	7114	6838
1991	3772	1478	9606	1749	600	536	17741	16718
1992			19212	3497		536	23245	21475
1993			19212	3497		536	23245	21054
1994			9606	2436		536	12578	11169
1995				1374		536	1910	1663
1996				1374		536	1910	1630
1997				1374		536	1910	1598
1998				3497		536	4033	3302
1999				3497		536	4033	3244
2000				3497		536	4033	3180
2001				14364*		536	14900	11518
TOTAL	9218	4966	57636	40156	3600	7504	123080	109784

* - DECOMMISSIONING COST

INITIAL PAYMENT = 95 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 62 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-36

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 884 SILOS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2044			600	752	4907	4907
1989	109	148			1200	752	2209	2166
1990	3826	2404			1200	752	8182	7864
1991	3772	2330	18025	2416	600	752	27895	26266
1992			36051	4832		752	41635	38464
1993			36051	4832		752	41635	37710
1994			18025	3247		752	22024	19557
1995				1661		752	2413	2101
1996				1661		752	2413	2059
1997				1661		752	2413	2019
1998				4832		752	5594	4581
1999				4832		752	5584	4451
2000				4832		752	5584	4403
2001				24859*		752	25611	19798
TOTAL	9218	6926	108152	59665	3600	10528	198089	176406

* - DECOMMISSIONING COST

INITIAL PAYMENT = 84 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 50 \$/kgU (INCLUDES \$ 9/kgU IMPACT AID)

TABLE A9-37

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1120 SILOS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2187			600	858	5156	5156
1989	109	148			1200	858	2315	2270
1990	3826	2932			1200	858	8766	8426
1991	3772	2808	22837	2797	600	858	33672	31730
1992			45674	5594		858	52126	48156
1993			45674	5594		858	52126	47212
1994			22837	3711		858	27406	24336
1995				1827		858	2685	2337
1996				1827		858	2685	2292
1997				1827		858	2685	2247
1998				5594		858	6452	5293
1999				5594		858	6452	5189
2000				5594		858	6452	5087
2001				30853*		858	31711	24514
TOTAL	9218	8025	137022	70812	3600	12012	240689	214245

* - DECOMMISSIONING COST

INITIAL PAYMENT = 82 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 46 \$/kgU (INCLUDES \$ 8/kgU IMPACT AID)

10.0 SENSITIVITY OF COSTS TO CHANGES IN CONDITIONS

The sensitivity of costs for FIS to changing conditions of cost, schedule, mix of spent fuel types, and discount rate, and to whether or not the facility was subject to NRC licensing, was determined for the drywell at storage capacity levels of 100 MTU and 1900 MTU. The following sections describe the conditions considered and the impact of each on the total discounted cost of FIS system construction and operation and the total unit cost.

10.1 IMPACT OF COST CHANGES

The impact of design improvements which result in a reduction in capital cost of a new transfer facility to \$15.5-million and \$10-million, and a reduction in the capital cost of modifying an existing transfer facility to \$8.2 million on FIS costs is shown in Table A10-1.

TABLE A10-1
IMPACT OF REDUCTIONS IN CAPITAL COSTS OF TRANSFER FACILITIES
ON FIS SYSTEM COSTS

<u>Capital Cost</u> <u>(\$-Millions)</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total</u> <u>Discounted</u> <u>Cost (\$000)</u>	<u>Total</u> <u>Unit</u> <u>Cost (\$/kgU)</u>	<u>Total</u> <u>Discounted</u> <u>Cost (\$000)</u>	<u>Total</u> <u>Unit</u> <u>Cost (\$/kgU)</u>
<u>New Facility Cases</u>				
\$21.9 (Base Case)	\$60,286	\$640	\$223,177	\$134
15.5	52,878	565	215,760	129
10	46,522	500	209,404	126
Change per \$-million	1,157	12	1,157	1
<u>Existing Facility Cases</u>				
9.2 (Base Case)	\$43,794	\$471	\$204,959	\$124
8.2	42,361	459	203,784	122
Change per \$-million	1,163	12	1,175	2

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-1 are set forth in Tables A10-2 through A10-7.

TABLE A10-2
COST SENSITIVITY CASE -- \$15.5-MILLION TRANSFER FACILITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	2699	1736			600	220	5255	5255
1989	238	148			1200	220	1806	1771
1990	6341	1952			1200	220	9713	9336
1991	6222	1879	1044	1040	600	220	11005	10370
1992			2088	2079		220	4387	4053
1993			2088	2079		220	4387	3973
1994			1044	1962		220	3226	2863
1995				1845		220	2065	1798
1996				1845		220	2065	1762
1997				1845		220	2065	1728
1998				2079		220	2299	1886
1999				2079		220	2299	1849
2000				2079		220	2299	1813
2001				5496*		220	5716	4419
TOTAL	15500	5715	6264	24428	3600	3080	58587	52878

* - DECOMMISSIONING COST

INITIAL PAYMENT = 309 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 256 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-3
COST SENSITIVITY CASE -- \$10-MILLION TRANSFER FACILITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1982	1736			600	220	4538	4538
1989	838	148			1200	220	1806	1771
1990	3950	1952			1200	220	7322	7038
1991	3831	1879	1044	1025	600	220	8599	8103
1992			2088	2050		220	4358	4026
1993			2088	2050		220	4358	3947
1994			1044	1933		220	3197	2839
1995				1816		220	2036	1772
1996				1816		220	2036	1738
1997				1816		220	2036	1704
1998				2050		220	2270	1862
1999				2050		220	2270	1826
2000				2050		220	2270	1790
2001				4396*		220	4616	3568
TOTAL	10001	5715	6264	23052	3600	3080	51712	46522

* - DECOMMISSIONING COST

INITIAL PAYMENT = 256 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 244 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-4
COST SENSITIVITY CASE -- \$15.5-MILLION TRANSFER FACILITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(*000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	2699	2174			600	858	6331	6331
1989	238	148			1200	858	2444	2396
1990	6341	3413			1200	858	11812	11353
1991	6222	3340	19811	3657	600	858	34488	32499
1992			39623	7313		858	47794	44154
1993			39623	7313		858	47794	43289
1994			19811	5218		858	25887	22987
1995				3122		858	3980	3465
1996				3122		858	3980	3397
1997				3122		858	3980	3330
1998				7313		858	8171	6703
1999				7313		858	8171	6572
2000				7313		858	8171	6443
2001				28689*		858	29547	22841
TOTAL	15500	9075	118868	83495	3600	12012	242550	215760

* - DECOMMISSIONING COST

INITIAL PAYMENT = 77 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 52 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-5
COST SENSITIVITY CASE -- \$10-MILLION TRANSFER FACILITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(*000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1982	2174			600	858	5614	5614
1989	238	148			1200	858	2444	2396
1990	3950	3413			1200	858	9421	9055
1991	3831	3340	19811	3642	600	858	32082	30232
1992			39623	7284		858	47765	44127
1993			39623	7284		858	47765	43262
1994			19811	3189		858	25858	22961
1995				3094		858	3952	3440
1996				3094		858	3952	3373
1997				3094		858	3952	3307
1998				7284		858	8142	6679
1999				7284		858	8142	6548
2000				7284		858	8142	6420
2001				27589*		858	28447	21990
TOTAL	10001	9075	118868	82122	3600	12012	235678	209404

* - DECOMMISSIONING COST

INITIAL PAYMENT = 74 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 52 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-6
COST SENSITIVITY CASE -- \$8.2-MILLION TRANSFER FACILITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1379	1763			600	220	3962	3962
1989	109	148			1200	220	1677	1644
1990	3383	2043			1200	220	6846	6580
1991	3329	1969	1044	1021	600	220	8183	7711
1992			2088	2042		220	4350	4019
1993			2088	2042		220	4350	3940
1994			1044	1587		220	2851	2532
1995				1132		220	1352	1177
1996				1132		220	1352	1154
1997				1132		220	1352	1131
1998				2042		220	2262	1856
1999				2042		220	2262	1819
2000				2042		220	2262	1784
2001				4077*		220	4297	3322
TOTAL	8200	5923	6264	20291	3600	3080	47358	42631

* - DECOMMISSIONING COST

INITIAL PAYMENT = 240 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 219 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-7
COST SENSITIVITY CASE -- \$8.2-MILLION TRANSFER FACILITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1379	2201			600	858	5038	5038
1989	109	148			1200	858	2315	2270
1990	3383	3504			1200	858	8345	8598
1991	3329	3430	19811	3638	600	858	31666	29840
1992			39623	7276		858	47757	44120
1993			39623	7276		858	47757	43255
1994			19811	4555		858	25224	22398
1995				1833		858	2691	2343
1996				1833		858	2691	2297
1997				1833		858	2691	2252
1998				7276		858	8134	6673
1999				7276		858	8134	6542
2000				7276		858	8134	6414
2001				27270*		858	28128	21744
TOTAL	8200	9283	118868	77342	3600	12012	229305	203784

* - DECOMMISSIONING COST

INITIAL PAYMENT = 73 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 49 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

The impact of reductions in the cost of individual modules (drywells) and canisters on FIS costs is shown in Table A10-8.

TABLE A10-8
IMPACT OF REDUCTIONS IN COST OF DRYWELLS AND CANISTERS
ON FIS SYSTEM COSTS

<u>Item Cost (\$)</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
<u>Drywells</u>				
\$21,751	\$60,286	\$640	\$223,177	\$134
15,000	58,519	622	189,571	115
10,000	57,212	609	164,676	99
Change per \$-thousand	262	3	4,978	3
<u>Canisters</u>				
\$ 4,794	\$60,286	\$640	\$223,177	\$134
3,500	59,959	637	216,981	130
2,000	59,581	632	209,796	126
Change per \$-thousand	252	3	4,789	3

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-8 are set forth in Tables A10-9 through A10-16.

TABLE A10-9

COST SENSITIVITY CASE -- \$15,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STDR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	779	1052	600	220	13545	12764
1992			1557	2103		220	3880	3585
1993			1557	2103		220	3880	3514
1994			779	1986		220	2985	2651
1995				1869		220	2089	1819
1996				1869		220	2089	1783
1997				1869		220	2089	1748
1998				2103		220	2323	1906
1999				2103		220	2323	1868
2000				2103		220	2323	1832
2001				6462*		220	6682	5165
TOTAL	21924	5715	4672	25622	3600	3080	64613	58519

* - DECOMMISSIONING COST

INITIAL PAYMENT = 356 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 266 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-10

COST SENSITIVITY CASE -- \$10,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	582	1049	600	220	13345	12575
1992			1164	2098		220	3482	3217
1993			1164	2098		220	3482	3154
1994			582	1981		220	2783	2471
1995				1863		220	2083	1813
1996				1863		220	2083	1778
1997				1863		220	2083	1743
1998				2098		220	2318	1902
1999				2098		220	2318	1864
2000				2098		220	2318	1828
2001				6226*		220	6446	4983
TOTAL	21924	5715	3492	25335	3600	3080	63146	57212

* - DECOMMISSIONING COST

INITIAL PAYMENT = 345 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 264 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-11

COST SENSITIVITY CASE -- \$15,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	14773	3595	600	858	32181	30325
1992			29546	7190		858	37594	34731
1993			29546	7190		858	37594	34050
1994			14773	5095		858	20726	18404
1995				2999		858	3857	3358
1996				2999		858	3857	3292
1997				2999		858	3857	3227
1998				7190		858	8048	6602
1999				7190		858	8048	6473
2000				7190		858	8048	6346
2001				23927*		858	24785	19160
TOTAL	21924	9075	88638	77564	3600	12012	212813	189571

* - DECOMMISSIONING COST

INITIAL PAYMENT = 66 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 49 \$/kgU (INCLUDES \$ 7/kgU IMPACT AID)

TABLE A10-12

COST SENSITIVITY CASE -- \$10,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	11041	3537	600	858	28391	26753
1992			22083	7074		858	30015	27729
1993			22083	7074		858	30015	27186
1994			11041	4979		858	16878	14987
1995				2883		858	3741	3257
1996				2883		858	3741	3193
1997				2883		858	3741	3130
1998				7074		858	7932	6507
1999				7074		858	7932	6379
2000				7074		858	7932	6254
2001				19449*		858	20307	15698
TOTAL	21924	9075	66248	71984	3600	12012	184843	164676

* - DECOMMISSIONING COST

INITIAL PAYMENT = 54 \$/kgU (INCLUDES \$ 3/kgU IMPACT AID)

FINAL PAYMENT = 45 \$/kgU (INCLUDES \$ 6/kgU IMPACT AID)

TABLE A10-13
COST SENSITIVITY CASE -- \$3,500 CANISTER
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	993	1056	600	220	13763	12969
1992			1986	2111		220	4317	3988
1993			1986	2111		220	4317	3910
1994			993	1994		220	3207	2848
1995				1877		220	2097	1826
1996				1877		220	2097	1790
1997				1877		220	2097	1755
1998				2111		220	2331	1912
1999				2111		220	2331	1875
2000				2111		220	2331	1838
2001				6719*		220	6939	5364
TOTAL	21924	5715	5958	25953	3600	3080	66232	59959

* - DECOMMISSIONING COST

INITIAL PAYMENT = 368 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 269 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-14
COST SENSITIVITY CASE -- \$2,000 CANISTER
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	934	1056	600	220	13704	12914
1992			1868	2111		220	4199	3879
1993			1868	2111		220	4199	3803
1994			934	1994		220	3148	2795
1995				1877		220	2097	1826
1996				1877		220	2097	1790
1997				1877		220	2097	1755
1998				2111		220	2331	1912
1999				2111		220	2331	1875
2000				2111		220	2331	1838
2001				6649*		220	6869	5310
TOTAL	21924	5715	5604	25885	3600	3080	65808	59581

* - DECOMMISSIONING COST

INITIAL PAYMENT = 364 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 268 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-15

COST SENSITIVITY CASE -- \$3,500 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(*000, 1988)

YEAR	TRANS FACIL COSTS	STDR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	18846	3673	600	858	36332	34236
1992			37691	7346		858	45895	42400
1993			37691	7346		858	45895	41569
1994			18846	5251		858	24955	22159
1995				3156		858	4014	3494
1996				3156		858	4014	3426
1997				3156		858	4014	3359
1998				7346		858	8204	6730
1999				7346		858	8204	6598
2000				7346		858	8204	6469
2001				28815*		858	29673	22938
TOTAL	21924	9075	113074	83937	3600	12012	243622	216981

* - DECOMMISSIONING COST

INITIAL PAYMENT = 78 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 52 \$/kgU (INCLUDES \$ 8/kgU IMPACT AID)

TABLE A10-16

COST SENSITIVITY CASE -- \$2,000 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(*000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	17726	3673	600	858	35212	33181
1992			35452	7346		858	43656	40331
1993			35452	7346		858	43656	39541
1994			17726	5251		858	23835	21165
1995				3156		858	4014	3494
1996				3156		858	4014	3426
1997				3156		858	4014	3359
1998				7346		858	8204	6730
1999				7346		858	8204	6598
2000				7346		858	8204	6469
2001				27471*		858	28329	21899
TOTAL	21924	9075	106356	82593	3600	12012	235560	209796

* - DECOMMISSIONING COST

INITIAL PAYMENT = 74 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 52 \$/kgU (INCLUDES \$ 8/kgU IMPACT AID)

10.2 IMPACT OF SCHEDULE CHANGES

The impact on FIS costs of extending the FIS program by 2 years and by 5 years as a result of a delay in repository startup is shown in Table A10-17.

TABLE A10-17
IMPACT OF EXTENDING THE TERM OF THE FIS PROGRAM
ON FIS SYSTEM COSTS

Year of Completion of FIS Activities	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
2000 (Base Case)	\$60,286	\$640	\$223,177	\$134
2002	63,265	673	228,005	137
2005	67,516	719	234,896	142
Increase-per yr. of delay	1,446	16	2,344	2
Existing Transfer Facility Cases				
2000 (Base Case)	\$43,794	\$471	\$204,959	\$124
2002	45,649	491	207,725	125
2005	48,297	520	211,679	127
Increase-per yr. of delay	901	10	1,344	1

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-17 are set forth in Tables A10-18 through A10-25.

TABLE A10-18
COST SENSITIVITY CASE -- 2-YEAR EXTENSION OF FIS PROGRAM
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	BOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	1044	1056	600	220	13814	13017
1992			2088	2111		220	4419	4082
1993			2088	2111		220	4419	4002
1994			1044	1994		220	3258	2893
1995				1877		220	2097	1826
1996				1877		220	2097	1790
1997				1877		220	2097	1755
1998				1877		220	2097	1720
1999				1877		220	2097	1687
2000				2111		220	2331	1838
2001				2111		220	2331	1802
2002				2111		220	2331	1767
2003				6781*		220	7001	5202
TOTAL	21924	5715	6264	29771	3600	3520	70794	63265

* - DECOMMISSIONING COST

INITIAL PAYMENT = 371 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 302 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-19
COST SENSITIVITY CASE -- 5-YEAR EXTENSION OF FIS PROGRAM
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	BOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	1044	1056	600	220	13814	13017
1992			2088	2111		220	4419	4082
1993			2088	2111		220	4419	4002
1994			1044	1994		220	3258	2893
1995				1877		220	2097	1826
1996				1877		220	2097	1790
1997				1877		220	2097	1755
1998				1877		220	2097	1720
1999				1877		220	2097	1687
2000				1877		220	2097	1653
2001				1877		220	2097	1621
2002				1877		220	2097	1589
2003				2111		220	2331	1732
2004				2111		220	2331	1698
2005				2111		220	2331	1665
2006				6781*		220	7001	4902
TOTAL	21924	5715	6264	35402	3600	4180	77085	67516

* - DECOMMISSIONING COST

INITIAL PAYMENT = 371 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 348 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-20
COST SENSITIVITY CASE -- 2-YEAR EXTENSION OF FIS PROGRAM
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	19811	3673	600	858	37297	35146
1992			39623	7346		858	47827	44185
1993			39623	7346		858	47827	43318
1994			19811	5251		858	25920	23016
1995				3156		858	4014	3494
1996				3156		858	4014	3426
1997				3156		858	4014	3359
1998				3156		858	4014	3293
1999				3156		858	4014	3228
2000				7346		858	8204	6469
2001				7346		858	8204	6342
2002				7346		858	8204	6218
2003				29973*		858	30831	22908
TOTAL	21924	9075	118868	91407	3600	13728	258602	228005

* - DECOMMISSIONING COST

INITIAL PAYMENT = 80 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 57 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A10-21
COST SENSITIVITY CASE -- 5-YEAR EXTENSION OF FIS PROGRAM
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	19811	3673	600	858	37297	35146
1992			39623	7346		858	47827	44185
1993			39623	7346		858	47827	43318
1994			19811	5251		858	25920	23016
1995				3156		858	4014	3494
1996				3156		858	4014	3426
1997				3156		858	4014	3359
1998				3156		858	4014	3293
1999				3156		858	4014	3228
2000				3156		858	4014	3165
2001				3156		858	4014	3103
2002				3156		858	4014	3042
2003				7346		858	8204	6096
2004				7346		858	8204	5976
2005				7346		858	8204	5859
2006				29973*		858	30831	21587
TOTAL	21924	9075	118868	100875	3600	16302	270644	234896

* - DECOMMISSIONING COST

INITIAL PAYMENT = 81 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 61 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A10-22
COST SENSITIVITY CASE -- 2-YEAR EXTENSION OF FIS PROGRAM
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(#000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1644
1990	3823	2043			1200	220	7286	7003
1991	3769	1969	1044	1024	600	220	8626	8128
1992			2088	2047		220	4355	4023
1993			2088	2047		220	4355	3944
1994			1044	1592		220	2856	2536
1995				1136		220	1356	1180
1996				1136		220	1356	1157
1997				1136		220	1356	1135
1998				1136		220	1356	1112
1999				1136		220	1356	1091
2000				2047		220	2267	1788
2001				2047		220	2267	1752
2002				2047		220	2267	1718
2003				4280*		220	4500	3344
TOTAL	9212	5923	6264	22811	3600	3520	51330	45649

* - DECOMMISSIONING COST

INITIAL PAYMENT = 249 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 242 \$/KgU (INCLUDES * 10/KgU IMPACT AID)

TABLE A10-23
COST SENSITIVITY CASE -- 5-YEAR EXTENSION OF FIS PROGRAM
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(#000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1644
1990	3823	2043			1200	220	7286	7003
1991	3769	1969	1044	1024	600	220	8626	8128
1992			2088	2047		220	4355	4023
1993			2088	2047		220	4355	3944
1994			1044	1592		220	2856	2536
1995				1136		220	1356	1180
1996				1136		220	1356	1157
1997				1136		220	1356	1135
1998				1136		220	1356	1112
1999				1136		220	1356	1091
2000				1136		220	1356	1069
2001				1136		220	1356	1048
2002				1136		220	1356	1028
2003				2047		220	2267	1684
2004				2047		220	2267	1651
2005				2047		220	2267	1619
2006				4280*		220	4500	3151
TOTAL	9212	5923	6264	26219	3600	4180	55398	48297

* - DECOMMISSIONING COST

INITIAL PAYMENT = 249 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 271 \$/KgU (INCLUDES * 10/KgU IMPACT AID)

TABLE A10-24

COST SENSITIVITY CASE -- 2-YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(#000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			1200	858	2315	2270
1990	3823	3504			1200	858	9385	9021
1991	3769	3430	19811	3641	600	858	32109	30257
1992			39623	7282		858	47763	44126
1993			39623	7282		858	47763	43260
1994			19811	4561		858	25230	22404
1995				1839		858	2697	2348
1996				1839		858	2697	2302
1997				1839		858	2697	2257
1998				1839		858	2697	2212
1999				1839		858	2697	2169
2000				7282		858	8140	6418
2001				7282		858	8140	6292
2002				7282		858	8140	6169
2003				27473*		858	28331	21050
TOTAL	9212	9283	118868	81280	3600	13728	235971	207725

* - DECOMMISSIONING COST

INITIAL PAYMENT = 74 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 51 \$/kgU (INCLUDES \$ 8/kgU IMPACT AID)

TABLE A10-25

COST SENSITIVITY CASE -- 5-YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(#000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			1200	858	2315	2270
1990	3823	3504			1200	858	9385	9021
1991	3769	3430	19811	3641	600	858	32109	30257
1992			39623	7282		858	47763	44126
1993			39623	7282		858	47763	43260
1994			19811	4561		858	25230	22404
1995				1839		858	2697	2348
1996				1839		858	2697	2302
1997				1839		858	2697	2257
1998				1839		858	2697	2212
1999				1839		858	2697	2169
2000				1839		858	2697	2127
2001				1839		858	2697	2085
2002				1839		858	2697	2044
2003				7282		858	8140	6048
2004				7282		858	8140	5930
2005				7282		858	8140	5813
2006				27473*		858	28331	19836
TOTAL	9212	9283	118868	86797	3600	16302	244062	211679

* - DECOMMISSIONING COST

INITIAL PAYMENT = 74 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 53 \$/kgU (INCLUDES \$ 8/kgU IMPACT AID)

The impact on FIS costs of spreading the time for receipt of spent fuel at the FIS facility from the 3-year period set forth in Section 3.4 to a total of 4 years and 5 years, respectively, is shown in Table A10-26.

TABLE A10-26
IMPACT OF SPREADING THE TIME FOR RECEIPTS OF SPENT FUEL
AT FIS FACILITIES ON FIS SYSTEM COSTS

<u>Number of Years Spent Fuel Received</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
New Transfer Facility Cases				
3 yrs. (Base Case)	\$60,286	\$640	\$223,177	\$134
4 yrs.	60,223	642	221,083	134
5 yrs.	60,166	643	219,014	133
Change per yr. of receipt time	-60	+2	-2,082	-0.5
Existing Transfer Facility Cases				
3 yrs. (Base Case)	\$43,794	\$471	\$204,959	\$124
4 yrs.	44,323	479	203,964	123
5 yrs.	44,853	487	202,974	123
Change per yr. of receipt time	+530	+8	-993	-0.5

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-26 are set forth in Tables A10-27 through A10-34.

TABLE A10-27

COST SENSITIVITY CASE -- 4-YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	783	1026	600	220	13523	12743
1992			1566	2052		220	3838	3546
1993			1566	2052		220	3838	3476
1994			1566	2052		220	3838	3408
1995			783	1965		220	2968	2584
1996				1877		220	2097	1790
1997				1877		220	2097	1755
1998				2111		220	2331	1912
1999				2111		220	2331	1875
2000				2111		220	2331	1838
2001				6781*		220	7001	5412
TOTAL	21924	5715	6264	26015	3600	3080	66598	60223

* - DECOMMISSIONING COST

INITIAL PAYMENT = 370 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 272 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-28

COST SENSITIVITY CASE -- 5-YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	626	1009	600	220	13349	12579
1992			1253	2018		220	3491	3225
1993			1253	2018		220	3491	3162
1994			1253	2018		220	3491	3100
1995			1253	2018		220	3491	3039
1996			626	1948		220	2794	2385
1997				1877		220	2097	1755
1998				2111		220	2331	1912
1999				2111		220	2331	1875
2000				2111		220	2331	1838
2001				6781*		220	7001	5412
TOTAL	21924	5715	6264	26020	3600	3080	66603	60166

* - DECOMMISSIONING COST

INITIAL PAYMENT = 369 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 274 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-29

COST SENSITIVITY CASE -- 4-YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	14859	3022	600	858	31694	29866
1992			29717	6043		858	36618	33829
1993			29717	6043		858	36618	33166
1994			29717	6043		858	36618	32516
1995			14859	4600		858	20317	17687
1996				3156		858	4014	3426
1997				3156		858	4014	3359
1998				7346		858	8204	6730
1999				7346		858	8204	6598
2000				7346		858	8204	6469
2001				29974*		858	30832	23834
TOTAL	21924	9075	118869	84075	3600	12012	249535	221083

* - DECOMMISSIONING COST

INITIAL PAYMENT = 80 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 54 \$/kgU (INCLUDES \$ 9/kgU IMPACT AID)

TABLE A10-30

COST SENSITIVITY CASE -- 5-YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2396
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	11887	2630	600	858	28330	26596
1992			23774	5260		858	29892	27616
1993			23774	5260		858	29892	27074
1994			23774	5260		858	29892	26543
1995			23774	5260		858	29892	26023
1996			11887	4208		858	16953	14469
1997				3156		858	4014	3359
1998				7346		858	8204	6730
1999				7346		858	8204	6598
2000				7346		858	8204	6469
2001				29974*		858	30832	23834
TOTAL	21924	9075	118870	83046	3600	12012	248527	219014

* - DECOMMISSIONING COST

INITIAL PAYMENT = 79 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 54 \$/kgU (INCLUDES \$ 9/kgU IMPACT AID)

TABLE A10-31

COST SENSITIVITY CASE -- 4-YEAR RECEIPT OF SPENT FUEL
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1644
1990	3823	2043			1200	220	7286	7003
1991	3769	1969	783	994	600	220	8335	7854
1992			1566	1987		220	3773	3486
1993			1566	1987		220	3773	3417
1994			1566	1987		220	3773	3350
1995			783	1562		220	2565	2233
1996				1136		220	1356	1157
1997				1136		220	1356	1135
1998				2047		220	2267	1860
1999				2047		220	2267	1823
2000				2047		220	2267	1788
2001				4280*		220	4500	3479
TOTAL	9212	5923	6264	21210	3600	3080	49289	44323

* - DECOMMISSIONING COST

INITIAL PAYMENT = 249 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 230 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-32

COST SENSITIVITY CASE -- 5-YEAR RECEIPT OF SPENT FUEL
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1644
1990	3823	2043			1200	220	7286	7003
1991	3769	1969	626	977	600	220	8161	7690
1992			1253	1954		220	3427	3166
1993			1253	1954		220	3427	3104
1994			1253	1954		220	3427	3043
1995			1253	1954		220	3427	2983
1996			626	1545		220	2391	2041
1997				1136		220	1356	1135
1998				2047		220	2267	1860
1999				2047		220	2267	1823
2000				2047		220	2267	1788
2001				4280*		220	4500	3479
TOTAL	9212	5923	6264	21895	3600	3080	49974	44853

* - DECOMMISSIONING COST

INITIAL PAYMENT = 248 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 239 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-33

COST SENSITIVITY CASE -- 4-YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			1200	858	2315	2270
1990	3823	3504			1200	858	9385	9021
1991	3769	3430	14859	2990	600	858	26506	24977
1992			29717	5979		858	36554	33770
1993			29717	5979		858	36554	33108
1994			29717	5979		858	36554	32459
1995			14859	3909		858	19626	17086
1996				1839		858	2697	2302
1997				1839		858	2697	2257
1998				7282		858	8140	6678
1999				7282		858	8140	6547
2000				7282		858	8140	6418
2001				27473*		858	28331	21901
TOTAL	9212	9283	118859	77833	3600	12012	230809	203964

* - DECOMMISSIONING COST

INITIAL PAYMENT = 73 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 50 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-34

COST SENSITIVITY CASE -- 5-YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			1200	858	2315	2270
1990	3823	3504			1200	858	9385	9021
1991	3769	3430	11887	2598	600	858	23142	21807
1992			23774	5196		858	29828	27556
1993			23774	5196		858	29828	27016
1994			23774	5196		858	29828	26486
1995			23774	5196		858	29828	25967
1996			11887	3518		858	16263	13880
1997				1839		858	2697	2257
1998				7282		858	8140	6678
1999				7282		858	8140	6547
2000				7282		858	8140	6418
2001				27473*		858	28331	21901
TOTAL	9212	9283	118870	78058	3600	12012	231035	202974

* - DECOMMISSIONING COST

INITIAL PAYMENT = 73 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 50 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

The impact on FIS costs of compressing the construction schedule for FIS facilities to a total of two years, compared with the base case of four years (implies no NRC licensing activities required), is shown in Table A10-35.

TABLE A10-35
IMPACT OF SHORTENING OF CONSTRUCTION TIME FOR FIS FACILITIES
ON FIS SYSTEM COSTS

FIS Facility Construction Time (yr)	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
4 yr. (Base Case)	\$60,286	\$640	\$223,177	\$134
2 yr.	65,004	680	235,067	139
Increase per yr. of schedule shortening	2,359	20	5,945	2.5
Existing Transfer Facility Cases				
4 yr. (Base Case)	\$43,794	\$471	\$204,959	\$124
2 yr.	46,762	495	214,056	127
Increase per yr. of schedule shortening	1,484	12	4,549	1.5

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-35 are set forth in Tables A10-36 through A10-39.

TABLE A10-36

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	12908	3836			500	220	17364	17364
1989	9015	1879	1044	1056	1200	220	14414	14131
1990			2088	2111	1200	220	5619	3401
1991			2088	2111	500	220	5019	4730
1992			1044	1994		220	3258	3010
1993				1877		220	2097	1899
1994				1877		220	2097	1862
1995				1877		220	2097	1826
1996				1877		220	2097	1790
1997				1877		220	2097	1753
1998				2111		220	2331	1912
1999				2111		220	2331	1875
2000				2111		220	2331	1838
2001				6780*		220	7000	5411
TOTAL	21923	5715	6264	29770	3600	3080	70352	63004

* - DECOMMISSIONING COST

INITIAL PAYMENT = 360 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 320 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-37

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	12908	5735			500	858	20101	20101
1989	9015	3340	19811	3673	1200	858	37897	37154
1990			39623	7346	1200	858	49027	47123
1991			39623	7346	500	858	48427	45634
1992			19811	5251		858	25920	23946
1993				3156		858	4014	3636
1994				3156		858	4014	3564
1995				3156		858	4014	3494
1996				3156		858	4014	3426
1997				3156		858	4014	3359
1998				7346		858	8204	6730
1999				7346		858	8204	6598
2000				7346		858	8204	6469
2001				29973*		858	30831	23833
TOTAL	21923	9075	118868	91407	3600	12012	256885	235067

* - DECOMMISSIONING COST

INITIAL PAYMENT = 81 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 58 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A10-38

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	5443	3953			600	220	10216	10216
1989	3769	1969	1044	1024	1200	220	9226	9045
1990			2088	2047	1200	220	5353	5339
1991			2088	2047	600	220	4953	4669
1992			1044	1592		220	2856	2639
1993				1136		220	1356	1228
1994				1136		220	1356	1204
1995				1136		220	1356	1180
1996				1136		220	1356	1157
1997				1136		220	1356	1135
1998				2047		220	2267	1860
1999				2047		220	2267	1823
2000				2047		220	2267	1788
2001				4280*		220	4500	3479
TOTAL	9212	5922	6264	22811	3600	3080	50889	46762

* - DECOMMISSIONING COST

INITIAL PAYMENT = 235 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 260 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-39

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	5443	5853			600	858	12754	12754
1989	3769	3430	19811	3641	1200	858	32709	32058
1990			39623	7282	1200	858	48963	47062
1991			39623	7282	600	858	48363	45574
1992			19811	4561		858	25230	23309
1993				1839		858	2697	2443
1994				1839		858	2697	2395
1995				1839		858	2697	2348
1996				1839		858	2697	2302
1997				1839		858	2697	2257
1998				7282		858	8140	6678
1999				7282		858	8140	6547
2000				7282		858	8140	6418
2001				27473*		858	28331	21901
TOTAL	9212	9283	118868	81280	3600	12012	234253	214056

* - DECOMMISSIONING COST

INITIAL PAYMENT = 75 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 52 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

10.3 IMPACT OF MIX OF SPENT FUEL TYPES

In developing the costs for FIS storage described in Section 9.0 of this Exhibit A, it was assumed that a mix of spent fuel would be received such that an average loading of a drywell would be 0.429 MTU (two-thirds of the fuel received would be PWR fuel containing 0.461 MTU/assembly, and one third of the fuel received would be BWR fuel containing 0.183 MTU/assembly -- with one PWR or two BWR assemblies being contained in a single drywell). The impact of receiving 100% PWR and 100% BWR fuel on FIS costs is shown in Table A10-40.

TABLE A10-40
IMPACT OF AMOUNT OF URANIUM CONTAINED IN A DRYWELL ON FIS SYSTEM COSTS

	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
New Transfer Facility Cases				
67% PWR Fuel (Base Case)	\$60,286	\$640	\$223,177	\$134
100% PWR Fuel	59,745	634	212,758	128
100% BWR Fuel	61,362	650	243,985	146
Change per kg/U difference in average content of drywell	17	0.17	329	0.19
Existing Transfer Facility Cases				
67% PWR Fuel (Base Case)	\$43,794	\$471	\$204,959	\$124
100% PWR Fuel	43,245	466	194,539	116
100% BWR Fuel	44,872	482	224,734	135
Change per kg/U difference in average content of drywell	17	0.17	318	0.2

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-40 are set forth in Tables A10-41 through A10-48.

TABLE A10-41

COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 217 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1737			600	220	6094	6094
1989	238	148			1200	220	1806	1771
1990	9134	1953			1200	220	12509	12023
1991	9015	1881	960	1055	600	220	13731	12939
1992			1920	2110		220	4250	3926
1993			1920	2110		220	4250	3849
1994			960	1993		220	3173	2818
1995				1876		220	2096	1825
1996				1876		220	2096	1789
1997				1876		220	2096	1754
1998				2110		220	2330	1911
1999				2110		220	2330	1874
2000				2110		220	2330	1837
2001				6681*		220	6901	5335
TOTAL	21924	5721	5760	25907	3600	3080	65992	59745

* - DECOMMISSIONING COST

INITIAL PAYMENT = 366 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 268 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-42

COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 273 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1734			600	220	6091	6091
1989	238	148			1200	220	1806	1771
1990	9134	1947			1200	220	12501	12016
1991	9015	1873	1208	1058	600	220	13974	13168
1992			2416	2116		220	4752	4390
1993			2416	2116		220	4752	4304
1994			1208	1999		220	3427	3043
1995				1881		220	2101	1829
1996				1881		220	2101	1793
1997				1881		220	2101	1758
1998				2116		220	2336	1916
1999				2116		220	2336	1879
2000				2116		220	2336	1842
2001				6975*		220	7195	5562
TOTAL	21924	5702	7248	26255	3600	3080	67809	61362

* - DECOMMISSIONING COST

INITIAL PAYMENT = 379 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 271 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-43

COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4121 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2179			600	858	7174	7174
1989	238	148			1200	858	2444	2396
1990	9134	3431			1200	858	14623	14053
1991	9015	3357	18232	3653	600	858	35715	33655
1992			36464	7306		858	44628	41229
1993			36464	7306		858	44628	40421
1994			18232	5211		858	24301	21579
1995				3115		858	3973	3459
1996				3115		858	3973	3391
1997				3115		858	3973	3324
1998				7306		858	8164	6597
1999				7306		858	8164	6566
2000				7306		858	8164	6437
2001				28086*		858	28944	22375
TOTAL	21924	9115	109392	82825	3600	12012	238868	212758

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES * 4/KgU IMPACT AID)

FINAL PAYMENT = 52 \$/KgU (INCLUDES * 8/KgU IMPACT AID)

TABLE A10-44

COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5191 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2164			600	858	7159	7159
1989	238	148			1200	858	2444	2396
1990	9134	3379			1200	858	14571	14005
1991	9015	3305	22966	3713	600	858	40457	38124
1992			45932	7426		858	54216	50087
1993			45932	7426		858	54216	49105
1994			22966	5331		858	29155	25889
1995				3235		858	4093	3563
1996				3235		858	4093	3493
1997				3235		858	4093	3425
1998				7426		858	8284	6796
1999				7426		858	8284	6663
2000				7426		858	8284	6532
2001				33743*		858	34601	26748
TOTAL	21924	8996	137796	89622	3600	12012	273950	243985

* - DECOMMISSIONING COST

INITIAL PAYMENT = 90 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 56 \$/KgU (INCLUDES * 9/KgU IMPACT AID)

TABLE A10-45

COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 217 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1764			600	220	4095	4095
1989	109	148			1200	220	1677	1644
1990	3823	2045			1200	220	7288	7005
1991	3769	1971	960	1023	600	220	8543	8050
1992			1920	2045		220	4185	3866
1993			1920	2045		220	4185	3790
1994			960	1590		220	2770	2460
1995				1134		220	1354	1179
1996				1134		220	1354	1156
1997				1134		220	1354	1133
1998				2045		220	2265	1858
1999				2045		220	2265	1822
2000				2045		220	2265	1786
2001				4180*		220	4400	3401
TOTAL	9212	5928	5760	20420	3600	3080	48000	43245

* - DECOMMISSIONING COST

INITIAL PAYMENT = 245 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 221 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-46

COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 273 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1761			600	220	4092	4092
1989	109	148			1200	220	1677	1644
1990	3823	2037			1200	220	7280	6997
1991	3769	1963	1208	1026	600	220	8786	8279
1992			2416	2052		220	4688	4331
1993			2416	2052		220	4688	4246
1994			1208	1597		220	3025	2686
1995				1141		220	1361	1185
1996				1141		220	1361	1162
1997				1141		220	1361	1139
1998				2052		220	2272	1864
1999				2052		220	2272	1827
2000				2052		220	2272	1791
2001				4474*		220	4694	3629
TOTAL	9212	5909	7248	20780	3600	3080	49829	44872

* - DECOMMISSIONING COST

INITIAL PAYMENT = 258 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 224 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-47
COST SENSITIVITY CASE -- 100% PWR FUEL
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4121 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2206			600	858	5175	5175
1989	109	148			1200	858	2315	2270
1990	3823	3521			1200	858	9402	9037
1991	3769	3447	18232	3621	600	858	30527	28766
1992			36464	7242		858	44564	41170
1993			36464	7242		858	44564	40363
1994			18232	4521		858	23611	20966
1995				1799		858	2657	2313
1996				1799		858	2657	2268
1997				1799		858	2657	2223
1998				7242		858	8100	6645
1999				7242		858	8100	6515
2000				7242		858	8100	6387
2001				25385*		858	26443	20441
TOTAL	9212	9322	109392	75334	3600	12012	218872	194539

* - DECOMMISSIONING COST

INITIAL PAYMENT = 69 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 47 \$/KgU (INCLUDES \$ 7/KgU IMPACT AID)

TABLE A10-48
COST SENSITIVITY CASE -- 100% BWR FUEL
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5191 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1455			600	858	4424	4424
1989	109	66			1200	858	2233	2189
1990	3823	3428			1200	858	9309	8948
1991	3769	3395	22966	3679	600	858	35267	33233
1992			45932	7357		858	54147	50023
1993			45932	7357		858	54147	49043
1994			22966	4636		858	28460	25272
1995				1914		858	2772	2413
1996				1914		858	2772	2366
1997				1914		858	2772	2319
1998				7357		858	8215	6739
1999				7357		858	8215	6607
2000				7357		858	8215	6477
2001				31070*		858	31928	24681
TOTAL	9212	8344	137796	81912	3500	12012	252876	224734

* - DECOMMISSIONING COST

INITIAL PAYMENT = 83 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 52 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

10.4 IMPACT OF DISCOUNT RATE

The impact of changes to the discount rate used to calculate FIS service charges on FIS costs is shown in Table A10-49.

TABLE A10-49
IMPACT OF DISCOUNT RATE ON FIS SYSTEM COSTS

<u>Discount Rate</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
New Transfer Facility Cases				
2% (Base Case)	\$60,286	\$640	\$223,177	\$134
4%	55,007	604	200,171	124
6%	50,547	571	180,682	116
Decrease per percent increase in discount rate	2,435	17.3	10,624	4.5
Existing Transfer Facility Cases				
2% (Base Case)	\$43,794	\$471	\$204,959	\$124
4%	39,768	444	183,445	115
6%	36,374	421	165,219	107
Decrease per percent increase in discount rate	1,855	12.5	9,935	4.3

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-49 are set forth in Tables A10-50 through A10-57.

TABLE A10-50

COST SENSITIVITY CASE -- 4% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1737
1990	9134	1952			1200	220	12506	11563
1991	9015	1879	1044	1056	600	220	13814	12281
1992			2088	2111		220	4419	3777
1993			2088	2111		220	4419	3632
1994			1044	1994		220	3258	2575
1995				1877		220	2097	1594
1996				1877		220	2097	1532
1997				1877		220	2097	1473
1998				2111		220	2331	1575
1999				2111		220	2331	1514
2000				2111		220	2331	1456
2001				6781*		220	7001	4205
TOTAL	21924	5715	6264	26017	3600	3080	66600	55007

* - DECOMMISSIONING COST

INITIAL PAYMENT = 355 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 249 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-51

COST SENSITIVITY CASE -- 6% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1704
1990	9134	1952			1200	220	12506	11130
1991	9015	1879	1044	1056	600	220	13814	11599
1992			2088	2111		220	4419	3500
1993			2088	2111		220	4419	3302
1994			1044	1994		220	3258	2297
1995				1877		220	2097	1395
1996				1877		220	2097	1316
1997				1877		220	2097	1241
1998				2111		220	2331	1302
1999				2111		220	2331	1228
2000				2111		220	2331	1158
2001				6781*		220	7001	3282
TOTAL	21924	5715	6264	26017	3600	3080	66600	50547

* - DECOMMISSIONING COST

INITIAL PAYMENT = 340 \$/kgU (INCLUDES \$ 5/kgU IMPACT AID)

FINAL PAYMENT = 231 \$/kgU (INCLUDES \$ 10/kgU IMPACT AID)

TABLE A10-52

COST SENSITIVITY CASE -- 4% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2350
1990	9134	3413			1200	858	14605	13503
1991	9015	3340	19811	3673	600	858	37297	33157
1992			39623	7346		858	47827	40883
1993			39623	7346		858	47827	39310
1994			19811	5251		858	25920	20485
1995				3156		858	4014	3050
1996				3156		858	4014	2933
1997				3156		858	4014	2820
1998				7346		858	8204	5542
1999				7346		858	8204	5329
2000				7346		858	8204	5124
2001				29973*		858	30831	18516
TOTAL	21924	9075	118868	85095	3600	12012	250574	200171

* - DECOMMISSIONING COST

INITIAL PAYMENT = 75 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 49 \$/kgU (INCLUDES \$ 8/kgU IMPACT AID)

TABLE A10-53

COST SENSITIVITY CASE -- 6% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2306
1990	9134	3413			1200	858	14605	12998
1991	9015	3340	19811	3673	600	858	37297	31315
1992			39623	7346		858	47827	37883
1993			39623	7346		858	47827	35739
1994			19811	5251		858	25920	18273
1995				3156		858	4014	2670
1996				3156		858	4014	2518
1997				3156		858	4014	2376
1998				7346		858	8204	4581
1999				7346		858	8204	4322
2000				7346		858	8204	4077
2001				29973*		858	30831	14455
TOTAL	21924	9075	118868	85095	3600	12012	250574	180682

* - DECOMMISSIONING COST

INITIAL PAYMENT = 70 \$/kgU (INCLUDES \$ 4/kgU IMPACT AID)

FINAL PAYMENT = 46 \$/kgU (INCLUDES \$ 8/kgU IMPACT AID)

TABLE A10-54
COST SENSITIVITY CASE -- 4% DISCOUNT RATE
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1613
1990	3823	2043			1200	220	7286	6736
1991	3769	1969	1044	1024	600	220	8626	7668
1992			2088	2047		220	4355	3723
1993			2088	2047		220	4355	3579
1994			1044	1592		220	2856	2257
1995				1136		220	1356	1030
1996				1136		220	1356	991
1997				1136		220	1356	953
1998				2047		220	2267	1532
1999				2047		220	2267	1473
2000				2047		220	2267	1416
2001				4280*		220	4500	2703
TOTAL	9212	5923	6264	20539	3600	3080	48618	39768

* - DECOMMISSIONING COST

INITIAL PAYMENT = 237 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 207 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-55
COST SENSITIVITY CASE -- 6% DISCOUNT RATE
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1582
1990	3823	2043			1200	220	7286	6485
1991	3769	1969	1044	1024	600	220	8626	7243
1992			2088	2047		220	4355	3450
1993			2088	2047		220	4355	3254
1994			1044	1592		220	2856	2013
1995				1136		220	1356	902
1996				1136		220	1356	851
1997				1136		220	1356	803
1998				2047		220	2267	1266
1999				2047		220	2267	1194
2000				2047		220	2267	1127
2001				4280*		220	4500	2110
TOTAL	9212	5923	6264	20539	3600	3080	48618	36374

* - DECOMMISSIONING COST

INITIAL PAYMENT = 226 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 193 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-56

COST SENSITIVITY CASE -- 4% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			1200	858	2315	2226
1990	3823	3504			1200	858	9385	8677
1991	3769	3430	19811	3641	600	858	32109	28545
1992			39623	7282		858	47763	40828
1993			39623	7282		858	47763	39258
1994			19811	4561		858	25230	19940
1995				1839		858	2697	2049
1996				1839		858	2697	1971
1997				1839		858	2697	1895
1998				7282		858	8140	5499
1999				7282		858	8140	5288
2000				7282		858	8140	5084
2001				27473*		858	28331	17015
TOTAL	9212	9283	118868	77602	3600	12012	230577	183445

* - DECOMMISSIONING COST

INITIAL PAYMENT = 69 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 46 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-57

COST SENSITIVITY CASE -- 6% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			1200	858	2315	2184
1990	3823	3504			1200	858	9385	8353
1991	3769	3430	19811	3641	600	858	32109	26959
1992			39623	7282		858	47763	37833
1993			39623	7282		858	47763	35691
1994			19811	4561		858	25230	17786
1995				1839		858	2697	1794
1996				1839		858	2697	1692
1997				1839		858	2697	1596
1998				7282		858	8140	4545
1999				7282		858	8140	4288
2000				7282		858	8140	4045
2001				27473*		858	28331	13283
TOTAL	9212	9283	118868	77602	3600	12012	230577	165219

* - DECOMMISSIONING COST

INITIAL PAYMENT = 64 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 43 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

10.5 IMPACT OF NRC LICENSING STATUS

The impact on FIS costs of not having to license a FIS facility through the NRC is shown in Table A10-58. In this table the cost impact is shown separately for (i) not having to go through the formal NRC review of a safety analysis report, and hearings on construction and operation, but rather having internal DOE reviews only, (ii) not having to implement NRC security regulations but rather using the security protection afforded the existing site, and (iii) a combination of (i) and (ii).

TABLE A10-58
IMPACT ON FIS SYSTEM COSTS OF NOT HAVING TO LICENSE FIS FACILITIES

	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$60,286	\$640	\$223,177	\$134
No NRC Licensing Activities	58,503	622	221,381	133
Savings	1,783	18	1,796	1
No NRC Security	53,254	564	216,148	129
Savings	7,032	76	7,029	5
No NRC Licensing or Security	51,470	545	214,352	129
Savings	8,816	95	8,825	5
Existing Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$43,794	\$471	\$204,959	\$124
No NRC Licensing Activities	42,770	461	203,929	122
Savings	1,024	10	1,030	2
No NRC Security	36,770	394	197,923	119
Savings	7,024	77	7,036	5
No NRC Licensing or Security	35,740	384	196,900	118
Savings	8,054	87	8,059	6

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-58 are set forth in Tables A10-59 through A10-70.

TABLE A10-59

COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3084	1000			600	220	4904	4904
1989	109	66			1200	220	1595	1564
1990	9069	1911			1200	220	12400	11918
1991	9015	1879	1044	1053	600	220	13811	13014
1992			2088	2105		220	4413	4077
1993			2088	2105		220	4413	3997
1994			1044	1988		220	3252	2888
1995				1870		220	2090	1819
1996				1870		220	2090	1784
1997				1870		220	2090	1749
1998				2105		220	2325	1907
1999				2105		220	2325	1870
2000				2105		220	2325	1833
2001				6479*		220	6699	5179
TOTAL	21277	4856	6264	25655	3600	3080	64732	58503

* - DECOMMISSIONING COST

INITIAL PAYMENT = 356 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 266 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-60

COST SENSITIVITY CASE -- NO NRC SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	1736			600	220	6093	6093
1989	238	148			1200	220	1806	1771
1990	9134	1952			1200	220	12506	12020
1991	9015	1879	1044	625	600	220	13383	12611
1992			2088	1250		220	3558	3287
1993			2088	1250		220	3558	3223
1994			1044	1133		220	2397	2128
1995				1015		220	1235	1075
1996				1015		220	1235	1054
1997				1015		220	1235	1033
1998				1250		220	1470	1206
1999				1250		220	1470	1182
2000				1250		220	1470	1159
2001				6781*		220	7001	5412
TOTAL	21924	5715	6264	17834	3600	3080	58417	53254

* - DECOMMISSIONING COST

INITIAL PAYMENT = 371 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 193 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-61

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3084	1000			500	220	4904	4904
1989	109	66			1200	220	1595	1564
1990	9069	1911			1200	220	12400	11918
1991	9015	1879	1044	622	500	220	13380	12608
1992			2088	1243		220	3551	3281
1993			2088	1243		220	3551	3216
1994			1044	1126		220	2390	2122
1995				1009		220	1229	1070
1996				1009		220	1229	1049
1997				1009		220	1229	1028
1998				1243		220	1463	1200
1999				1243		220	1463	1177
2000				1243		220	1463	1154
2001				6479*		220	6699	5179
TOTAL	21277	4856	6264	17469	3500	3080	56546	51470

* - DECOMMISSIONING COST

INITIAL PAYMENT = 356 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 189 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-62

COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3084	1438			500	858	5980	5980
1989	109	66			1200	858	2233	2189
1990	9069	3372			1200	858	14499	13936
1991	9015	3340	19811	3669	500	858	37293	35142
1992			39623	7338		858	47819	44177
1993			39623	7338		858	47819	43311
1994			19811	5243		858	25912	23009
1995				3148		858	4006	3487
1996				3148		858	4006	3419
1997				3148		858	4006	3352
1998				7338		858	8196	6724
1999				7338		858	8196	6592
2000				7338		858	8196	6462
2001				29672*		858	30530	23501
TOTAL	21277	8216	118868	84718	3500	12012	248691	221381

* - DECOMMISSIONING COST

INITIAL PAYMENT = 80 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 53 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-63

COST SENSITIVITY CASE -- NO NRC SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3537	2174			600	858	7169	7169
1989	238	148			1200	858	2444	2596
1990	9134	3413			1200	858	14605	14038
1991	9015	3340	19811	3243	600	858	36867	34741
1992			39623	6485		858	46966	43389
1993			39623	6485		858	46966	42539
1994			19811	4390		858	25059	22252
1995				2294		858	3152	2744
1996				2294		858	3152	2690
1997				2294		858	3152	2637
1998				6485		858	7343	6024
1999				6485		858	7343	5906
2000				6485		858	7343	5790
2001				29973*		858	30831	23833
TOTAL	21924	9075	118868	76913	3600	12012	242392	216148

* - DECOMMISSIONING COST

INITIAL PAYMENT = 80 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 49 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-64

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	3084	1438			600	858	5980	5980
1989	109	66			1200	858	2233	2189
1990	9069	3372			1200	858	14499	13936
1991	9015	3340	19811	3239	600	858	36863	34737
1992			39623	6477		858	46958	43382
1993			39623	6477		858	46958	42531
1994			19811	4382		858	25051	22245
1995				2286		858	3144	2737
1996				2286		858	3144	2683
1997				2286		858	3144	2631
1998				6477		858	7335	6017
1999				6477		858	7335	5899
2000				6477		858	7335	5784
2001				29672*		858	30530	23601
TOTAL	21277	8216	118868	76536	3600	12012	240509	214352

* - DECOMMISSIONING COST

INITIAL PAYMENT = 80 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 49 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-65

COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1027			600	220	3358	3358
1989	109	66			1200	220	1595	1564
1990	3823	2002			1200	220	7245	6964
1991	3769	1969	1044	1021	600	220	8623	8126
1992			2088	2042		220	4350	4019
1993			2088	2042		220	4350	3940
1994			1044	1587		220	2851	2532
1995				1132		220	1352	1177
1996				1132		220	1352	1154
1997				1132		220	1352	1131
1998				2042		220	2262	1856
1999				2042		220	2262	1819
2000				2042		220	2262	1784
2001				4108*		220	4328	3346
TOTAL	9212	5064	6264	20322	3600	3080	47542	42770

* - DECOMMISSIONING COST

INITIAL PAYMENT = 241 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 220 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-66

COST SENSITIVITY CASE -- NO NRC SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1763			600	220	4094	4094
1989	109	148			1200	220	1677	1644
1990	3823	2043			1200	220	7286	7003
1991	3769	1969	1044	593	600	220	8195	7722
1992			2088	1186		220	3494	3228
1993			2088	1186		220	3494	3165
1994			1044	731		220	1995	1772
1995				276		220	496	432
1996				276		220	496	423
1997				276		220	496	415
1998				1186		220	1406	1153
1999				1186		220	1406	1131
2000				1186		220	1406	1109
2001				4280*		220	4500	3479
TOTAL	9212	5923	6264	12362	3600	3080	40441	36770

* - DECOMMISSIONING COST

INITIAL PAYMENT = 249 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 145 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-67

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1027			600	220	3358	3358
1989	109	66			1200	220	1595	1564
1990	3823	2002			1200	220	7245	6964
1991	3769	1969	1044	591	600	220	8193	7720
1992			2088	1181		220	3489	3223
1993			2088	1181		220	3489	3160
1994			1044	726		220	1990	1767
1995				271		220	491	427
1996				271		220	491	419
1997				271		220	491	411
1998				1181		220	1401	1149
1999				1181		220	1401	1127
2000				1181		220	1401	1105
2001				4108*		220	4328	3346
TOTAL	9212	5064	6264	12143	3600	3080	39363	35740

* - DECOMMISSIONING COST

INITIAL PAYMENT = 241 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 143 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-68

COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1465			600	858	4434	4434
1989	109	66			1200	858	2233	2189
1990	3823	3463			1200	858	9344	8981
1991	3769	3430	19811	3639	600	858	32107	30255
1992			39623	7277		858	47758	44121
1993			39623	7277		858	47758	43256
1994			19811	4536		858	25225	22399
1995				1834		858	2692	2344
1996				1834		858	2692	2298
1997				1834		858	2692	2253
1998				7277		858	8135	6674
1999				7277		858	8135	6543
2000				7277		858	8135	6414
2001				27301*		858	28159	21768
TOTAL	9212	8424	118868	77383	3600	12012	229499	203929

* - DECOMMISSIONING COST

INITIAL PAYMENT = .73 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 49 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-69
COST SENSITIVITY CASE -- NO NRC SECURITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	2201			600	858	5170	5170
1989	109	148			12007	858	2315	2270
1990	3823	3504			1200	858	9385	9021
1991	3769	3430	19811	3210	600	858	31678	29851
1992			39623	6420		858	46901	43329
1993			39623	6420		858	46901	42480
1994			19811	3699		858	24368	21638
1995				978		858	1836	1598
1996				978		858	1836	1567
1997				978		858	1836	1536
1998				6420		858	7278	5970
1999				6420		858	7278	5853
2000				6420		858	7278	5739
2001				27473*		858	28331	21901
TOTAL	9212	9283	118868	59416	3600	12012	222391	197923

* - DECOMMISSIONING COST

INITIAL PAYMENT = 74 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 45 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

TABLE A10-70
COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1988)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1988	1511	1465			600	858	4434	4434
1989	109	66			1200	858	2233	2189
1990	3823	3463			1200	858	9344	8981
1991	3769	3430	19811	3208	600	858	31676	29849
1992			39623	6416		858	46897	43326
1993			39623	6416		858	46897	42476
1994			19811	3695		858	24364	21635
1995				973		858	1831	1594
1996				973		858	1831	1563
1997				973		858	1831	1532
1998				6416		858	7274	5967
1999				6416		858	7274	5850
2000				6416		858	7274	5736
2001				27301*		858	28159	21768
TOTAL	9212	8424	118868	69203	3600	12012	221319	196900

* - DECOMMISSIONING COST

INITIAL PAYMENT = 73 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 45 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

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EXHIBIT B

ESTIMATED COSTS FOR TRANSPORT OF SPENT FUEL FROM VARIOUS
REACTOR SITES TO FEDERAL INTERIM STORAGE FACILITIES

EXHIBIT B
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EXHIBIT B
ESTIMATED COSTS FOR TRANSPORT OF SPENT FUEL FROM VARIOUS
REACTOR SITES TO FEDERAL INTERIM STORAGE FACILITIES

This Exhibit describes the development of the estimated costs of transporting spent fuel between each of twenty (20) specific reactor sites that are most likely to require FIS services, and two example locations of FIS facilities, one in the Eastern U.S. and one in the Western U.S. Costs have been developed for both truck transport and for rail transport, although the Department should use rail shipments wherever possible in order to minimize cask handling at FIS facilities -- especially in cases where the FIS storage capacity is above 300 MTU. A summary of the total costs is presented for transport by both truck and rail shipment between each point of origin and destination.

1.0 CASKS USED IN STUDY

A review was made of the availability and capability of various shipping casks in the United States and it was concluded therefrom that a determination of the estimated costs associated with transport of spent fuel from reactor sites to the FIS facilities would be made assuming that the NLI 1/2 or IF-300 casks would be used. The bases for this conclusion are set forth below:

- (1) Only two types of legal weight truck casks are currently authorized for use in the U.S., the NAC-1/NFS-4 and the NLI 1/2 casks. While there have been NRC licensing problems associated with the NAC-1/NFS-4 casks, no such problems have occurred with the NLI 1/2. Nuclear Assurance Corporation (NAC) has control of all NLI 1/2 casks and NAC-1/NFS-4 casks and has stated that the leasing charges would be about the same for either cask system.
- (2) At the present time there is only one rail cask which is both licensed and in current use in the United States. This is the IF-300 cask fabricated by General Electric. One other rail cask, the NLI 10/24, is licensed in the U.S. but is not currently in a usable condition. The others (TN 12 and NAC-3) are in some state of design, construction or are not approved by the NRC. Since the IF-300 now operates in the U.S. and can, therefore, provide current lease charges, it should provide costs which are representative of rail cask transport.

2.0 ESTIMATED COSTS OF CASK USE AND SERVICE

Estimates of the cask use charge for the NLI 1/2 cask were based on the NAC rate schedule prevailing as of January 1987 for this cask, as follows:

<u>No. Days of Use</u>	<u>Charge</u>
1 - 10 days	\$41,000(minimum charge)
11 - 30 days	1,900/day
31 - 90 days	1,400/day
91 - 180 days	1,000/day
181 - 365 days	900/day

Utilizing this rate schedule and assuming that a cask would be used 300 days/year, a cask use charge of \$1,203/day results. JAI assumed that a 5% increase in cask use charges would be applicable for 1988, resulting in a daily use charge for the NLI 1/2 cask of \$1,263/day (1988 dollars).

General Electric suggested the use of a 1988 rate of \$3,500/day for the use of the IF-300 rail cask.

3.0 FREIGHT COSTS

Freight charges for truck shipments between the various reactors and destinations, excluding escort charges, were determined using published tariffs. Freight charges for rail shipments were calculated using tariff information supplied by the Rockwell Hanford Operations Traffic Department.

3.1 TRUCK TARIFFS

The cost of shipment of spent fuel by truck consists of several separate charges:

- (1) a basic mileage commodity rate for both the loaded and empty cask,
- (2) a security charge, and
- (3) a vehicle detention charge.

The reference tariff is ICC TRSM 4007-A, dated October 15, 1984. Although originally issued in 1984, Tri-State Motor Transmit Co. (TSMT) has advised that all items in this tariff which are applicable to this study represent current 1987 prices when increased by a 6% insurance surcharge. TSMT recommends, however, increasing the 1987 rates by 5% to reflect proposed increases in 1988. Therefore, all rates used in this study which were taken from this tariff have been increased from the 1984 published value by 11.3% in order to provide a reasonable estimation of 1988 rates. The Mileage Commodity Rates are described in Item No. 2000 of the tariff. The rates are based on a cents per 100 pound basis and use a weight of 48,000 lbs for the empty cask and 49,000 lbs. for the loaded truck cask. Table B3-1 sets forth the estimated 1987 Mileage Commodity Rates for the distances pertinent to this study.

A security surveillance charge of \$1.02 per loaded mile is applicable to the shipment under Item 810-2 of the tariff. This provides for a guard or second driver to be present in the transport vehicle. A charge of \$0.17 per mile for the return of personnel is applicable to the return of the empty cask. A charge of \$0.20/per loaded mile for arming each driver-guard would apply only to shipments through the state of Virginia.

TABLE B3-1
RATES FOR TRANSPORT OF NLI 1/2 TRUCK CASK^a
(1988 Dollars)

Reactor to Destination	Rates in Dollars per 100 Pounds	
	<u>Loaded</u>	<u>Empty</u>
<u>From Palisades to</u>		
Eastern U.S. Site	4.44	3.01
Western U.S. Site	10.68	8.16
<u>From St. Lucie to</u>		
Eastern U.S. Site	5.14	3.74
Western U.S. Site	16.26	12.49
<u>From Robinson to</u>		
Eastern U.S. Site	3.27	1.93
Western U.S. Site	16.26	12.49
<u>From Brunswick to</u>		
Eastern U.S. Site	4.16	2.75
Western U.S. Site	16.00	12.28
<u>From LaSalle to</u>		
Eastern U.S. Site	4.06	2.65
Western U.S. Site	9.24	7.00
<u>From Oconee to</u>		
Eastern U.S. Site	2.58	1.49
Western U.S. Site	13.79	10.61
<u>From Pilgrim to</u>		
Eastern U.S. Site	5.90	4.46
Western U.S. Site	15.70	12.02
<u>From Indian Point to</u>		
Eastern U.S. Site	6.71	5.13
Western U.S. Site	15.15	11.56
<u>From Millstone to</u>		
Eastern U.S. Site	5.60	4.21
Western U.S. Site	15.44	11.82

TABLE B3-1 (Continued)
RATES FOR TRANSPORT OF NLI 1/2 TRUCK CASK^a
(1988 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Loaded</u>	<u>Empty</u>
<u>From Prairie Island to</u>		
Eastern U.S. Site	\$ 6.19	\$ 4.67
Western U.S. Site	9.15	6.91
<u>From La Crosse to</u>		
Eastern U.S. Site	5.42	3.96
Western U.S. Site	8.55	6.44
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	4.25	2.87
Western U.S. Site	14.29	11.10
<u>From Oyster Creek to</u>		
Eastern U.S. Site	4.82	3.47
Western U.S. Site	14.87	11.32
<u>From Byron to</u>		
Eastern U.S. Site	4.35	2.87
Western U.S. Site	8.42	6.44
<u>From Ft. Calhoun to</u>		
Eastern U.S. Site	6.02	4.58
Western U.S. Site	6.43	4.93

^aRates based upon Tariff ICC 4007-A, Item 2000, dated October 15, 1984 and escalated by 11.3% to approximate mid-1988 charges.

In addition to the charges detailed above, demurrage (detention) charges are applicable to each shipment and are covered in Item 500 of the tariff. The following rate schedule provides charges for the time required for loading at origination point and unloading at destination.

<u>Hours</u>	<u>Rate Per Hour Per Vehicle Used</u>
First 3	No Charge
4 - 8	\$19.48
9 - 16	\$25.04
17 - 24	\$30.61
All Over 24	\$36.17

The total turnaround time assumed for the NLI 1/2 truck cask, for this study, is 36 hours; 24 hours for loading and 12 hours for unloading. Therefore, the total detention charge, based on the above rate schedule, is \$542.60 for loading and \$197.56 for unloading for a total charge of \$740.16/round trip.

Escorts must be provided for each truck shipment as stipulated in 10 CFR Part 73.37. This regulation requires that the transport vehicle, using a pre-determined route, be escorted through each locality designated by the NRC as being a heavily populated urban area. In accordance with this regulation, the escort for a truck shipment is sufficient if the transport vehicle within a heavily populated area is:

- (a) Occupied by two individuals, one of whom serves as guard and escorted by an armed member of the local law enforcement agency in a mobile unit of such agency; or
- (b) Led by a separate vehicle occupied by a least one armed escort and trailed by a third vehicle occupied by at least one armed escort.

At the present time this escort service is provided by local law enforcement agencies in the manner described in (a), above, and is done free of charge. It is believed that as these shipments become routine some remuneration will be required by these local law enforcement agencies.

Therefore, for the purposes of this study, the following assumptions and estimates for determination of escort costs have been used:

- (1) Each major locality through which the shipment passes will require an escort.
- (2) Escorts in each of these localities will be provided by off-duty, local police at a charge of \$24.95/hr. per person, including provision of a vehicle.
- (3) A minimum of 4 hours will be required for transit from 5 miles outside the locality, through locality, to 5 miles on the other side of the locality.
- (4) The labor costs to make the necessary escort arrangements in each locality and the cost of communicating with each locality involved in a shipment (i.e., telephone, mail, telex) was estimated at \$60.

Taking into consideration the above assumptions and estimated costs, it was estimated that there would be a total cost of \$184 for escorting a shipment through each locality. This figure includes a 15% contingency to allow for such possibilities as the need for guards during equipment malfunction or compliance with state laws.

3.2 RAIL TARIFFS

Rail freight rates which were effective May 1, 1984 for Class 40 (loaded) and Class 37½ (empty) rail casks were provided by the Rockwell Hanford Operations Traffic Manager's Office. These rates were increased by 2.3% (based on the increase in the index for freight for Class I railroads from 1984 to that projected by JAI for 1988) to obtain the 1988 values set forth in Table B3-2.

TABLE B3-2
RAIL FREIGHT RATES
(1988 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Class 40 Loaded</u>	<u>Class 37½ Empty</u>
<u>From Palisades to</u>		
Eastern U.S. Site	6.65	6.24
Western U.S. Site	13.88	13.01
<u>From St. Lucie to</u>		
Eastern U.S. Site	7.82	7.32
Western U.S. Site	18.20	17.06
<u>From Robinson to</u>		
Eastern U.S. Site	5.37	5.03
Western U.S. Site	17.41	16.32
<u>From Brunswick to</u>		
Eastern U.S. Site	6.04	5.66
Western U.S. Site	17.89	16.78
<u>From LaSalle to</u>		
Eastern U.S. Site	6.00	5.63
Western U.S. Site	13.09	12.28
<u>From Ocone to</u>		
Eastern U.S. Site	4.70	4.40
Western U.S. Site	16.37	15.35
<u>From Pilgrim to</u>		
Eastern U.S. Site	9.00	8.44
Western U.S. Site	18.13	16.99
<u>From Indian Point to</u>		
Eastern U.S. Site	8.08	7.57
Western U.S. Site	17.77	16.66

TABLE B3-2 (Continued)

RAIL FREIGHT RATES
(1987 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Class 40 Loaded</u>	<u>Class 37½ Empty</u>
<u>From Millstone to</u>		
Eastern U.S. Site	\$ 8.59	\$ 8.06
Western U.S. Site	18.13	16.99
<u>From Prairie Island to</u>		
Eastern U.S. Site	8.86	8.31
Western U.S. Site	12.45	11.67
<u>From La Crosse to</u>		
Eastern U.S. Site	8.32	7.80
Western U.S. Site	12.63	11.85
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	6.55	6.14
Western U.S. Site	17.15	16.08
<u>From Oyster Creek to</u>		
Eastern U.S. Site	7.57	7.10
Western U.S. Site	17.65	16.54
<u>From Byron to</u>		
Eastern U.S. Site	7.21	6.76
Western U.S. Site	11.94	11.19
<u>From Ft. Calhoun to</u>		
Eastern U.S. Site	9.70	9.08
Western U.S. Site	9.93	9.30

3.2.1 Heavy Haul Charges

Heavy haul charges are applicable to this study in the case of ten reactor sites which do not have direct rail access. Also, these charges are assumed to apply in all 20 cases in which the destination is the Western U.S. facility which is assumed to be without direct rail access. The Eastern U. S. site is assumed to have direct rail access.

Heavy haul charges for the ten reactor sites without rail access comprise the following components:

- (1) Transport vehicle rental (including manpower)
- (2) Transfer equipment rental (including manpower)
- (3) Overweight permits (if necessary)

A summary of the heavy haul charges between the reactor sites that do not have direct rail access and the corresponding railhead, and between the railhead and the Western U.S. facility, is set forth in Table B3-3.

TABLE B3-3
ESTIMATED HEAVY HAUL & TRANSFER CHARGES PER ROUND TRIP SHIPMENT
OF AN IF-300 RAIL CASK
(1988 Dollars)

Reactor to Railhead/Railhead to Western U.S. FIS Facility					
<u>Reactor</u>	<u>One-Way Mileage</u>	<u>Heavy Haul Cost^a</u>	<u>Rigger Cost^b</u>	<u>Overweight Permit Cost^c</u>	<u>Total Cost</u>
St. Lucie	10	\$3,061	\$5,762	\$397	\$9,220
Pilgrim	25	3,621	5,762	95	9,478
Oconee	10	3,061	5,762	145	8,968
Indian Point	5	2,875	5,762	189	8,826
Millstone	5	2,875	5,762	221	8,858
Oyster Creek	25	3,621	5,762	1,260	10,643
Calvert Cliffs	50	4,555	5,762	2,121	12,438
Ft. Calhoun	6	2,912	5,762	183	8,857
Western U.S. FIS	27	3,696	5,762	-	9,458

^a Heavy haul cost for round trip of cask is determined as follows:

2x(4 hrs deadhead time plus 4 hrs loading time plus 4 hrs unloading time, plus transit time @ 6mph) @ \$112/hr.

^b Rigger cost for round trip of cask is determined as follows:

2x(4 hrs deadhead time plus 4 hrs loading/unloading time) @ \$155/hr, plus a crane charge @ \$1,641 per day, 2 days per round trip.

^c Permits required for cask and for crane for each transfer, Ref. Item 675, ICC Tariff TRSM-4007-A. Tariff values escalated to estimate 1988 charges.

3.2.2 Escort Charges

In accordance with 10 CFR Part 73.37, each rail shipment of spent fuel must provide (in addition to other provisions) that:

- "(1) A shipment car within a heavily populated area is accompanied by two armed escorts (who may be members of a local law enforcement agency), at least one of whom is stationed at a location on the train that will permit observation of the shipment car while in motion.
- (2) A shipment car not within any heavily populated area is accompanied by at least one escort stationed at a location on the train that will permit observation of the shipment car while in motion."

Since at this point in time NRC-approved routes cannot be determined (and consequently neither can the number of heavily populated areas), the cost of escort services was estimated on the basis of using two guards for the entire trip. In calculating the escort charge, the cost of equipment, rail fare, subsistence and return airfare was included.

4.0 TIME REQUIRED TO EFFECT A SPENT FUEL SHIPMENT

Many of the components of the cost of transport of spent fuel are dependent on the time required to effect a round trip shipment, therefore, a determination was made of the time required to effect a round trip shipment between each of the points of origin and destination being considered in this study.

An estimate was made of the one-way road miles between each reactor and each FIS site considered utilizing the most direct and major routes. The routes selected approximate the shortest distances from the reactors to the FIS sites and represent the route an empty cask would take; a 10% contingency was added to this distance for a loaded cask to avoid the center of urban areas. The applicable freight charges in each case were determined using the one-way distances estimated in this manner.

An average travel speed of 35 mph for a truck shipment was assumed for the calculation of the transport time involved. The turnaround time of 36 hours (12 hours for unloading and 24 hours for loading the cask) was added to the actual transit time to obtain the total time involved for a round trip shipment. The cask use and service charge and vehicle detention charges were calculated using these time estimates.

Table B4-1 presents the estimated shipping distances involved for truck shipments of spent fuel between the various shipping and receiving locations considered and the estimated time required to complete a round trip shipment.

TABLE B4-1
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF
SPENT FUEL BY NLI 1/2 TRUCK CASK

<u>Reactor to Destination</u>	<u>One-Way Distance</u> <u>(Miles)</u>		<u>Time Requirements</u>			
	<u>Loaded^a</u>	<u>Empty</u>	<u>Transport</u> <u>(Hours)^b</u>	<u>Turnaround</u> <u>(Hours)^c</u>	<u>Total</u> <u>(Hours)</u>	<u>Total</u> <u>(Days)</u>
<u>From Palisades to</u>						
Eastern U.S. Site	686	624	37	36	73	3.0
Western U.S. Site	1,884	1,713	103	36	139	5.8
<u>From St. Lucie to</u>						
Eastern U.S. Site	862	784	47	36	83	3.5
Western U.S. Site	2,890	2,647	158	36	194	8.1
<u>From Robinson to</u>						
Eastern U.S. Site	384	349	21	36	57	2.4
Western U.S. Site	2,875	2,614	157	36	193	8.0
<u>From Brunswick to</u>						
Eastern U.S. Site	606	551	33	36	69	2.9
Western U.S. Site	2,822	2,565	154	36	190	7.9
<u>From LaSalle to</u>						
Eastern U.S. Site	593	539	32	36	68	2.8
Western U.S. Site	1,648	1,498	90	36	126	5.3
<u>From Oconee to</u>						
Eastern U.S. Site	210	191	11	36	47	2.0
Western U.S. Site	2,450	2,227	134	36	170	7.1
<u>From Pilgrim to</u>						
Eastern U.S. Site	1,030	936	56	36	92	3.8
Western U.S. Site	2,773	2,521	151	36	187	7.8
<u>From Indian Point to</u>						
Eastern U.S. Site	1,199	1,090	65	36	101	4.2
Western U.S. Site	2,663	2,421	145	36	181	7.5
<u>From Millstone to</u>						
Eastern U.S. Site	979	890	53	36	89	3.7
Western U.S. Site	2,741	2,492	150	36	186	7.8
<u>From Prairie Island to</u>						
Eastern U.S. Site	1,098	998	60	36	96	4.0
Western U.S. Site	1,610	1,464	88	36	124	5.2

TABLE B4-1 (Continued)
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF
SPENT FUEL BY NLI 1/2 TRUCK CASK

<u>Reactor to Destination</u>	<u>One-Way Distance</u> <u>(Miles)</u>		<u>Time Requirements</u>			
	<u>Loaded^a</u>	<u>Empty</u>	<u>Transport</u> <u>(Hours)^b</u>	<u>Turnaround</u> <u>(Hours)^c</u>	<u>Total</u> <u>(Hours)</u>	<u>Total</u> <u>(Days)</u>
<u>From La Crosse to</u>						
Eastern U.S. Site	926	842	51	36	87	3.6
Western U.S. Site	1,507	1,370	82	36	118	4.9
<u>From Calvert Cliffs to</u>						
Eastern U.S. Site	641	583	35	36	71	3.0
Western U.S. Site	2,542	2,311	139	36	175	7.3
<u>From Oyster Creek to</u>						
Eastern U.S. Site	790	718	43	36	79	3.3
Western U.S. Site	2,639	2,399	144	36	180	7.5
<u>From Byron to</u>						
Eastern U.S. Site	660	600	36	36	72	3.0
Western U.S. Site	1,498	1,362	82	36	118	4.9
<u>From Ft. Calhoun to</u>						
Eastern U.S. Site	1,057	961	58	36	94	3.9
Western U.S. Site	1,132	1,029	62	36	98	4.1

^a Includes an allowance of 10% contingency to avoid center of urban areas but requires escort vehicles around such areas.

^b Assumes an average speed of 35 mph for legal weight truck casks; no restrictions on time of operation.

^c Turnaround at reactor - loading 24 hours.
 Turnaround at destination - unloading 12 hours.

Rail shipping distances were developed by Pacific Northwest Laboratories (PNL). These distances were determined as follows:

- (1) Rail tariffs for some of the shorter distances were found to contain actual mileages; these were used when available
- (2) Where rail tariffs did not show actual distances, a distance equal to 112 percent of the highway mileages was used since PNL determined, that on the average, rail distances were 10-12 percent longer than the corresponding highway distances.

Train speeds vary according to the routing and distance traveled. However, for the purposes of this study, the average rail transit speeds developed by PNL* were used. These were as follows:

<u>Total Distance (Miles)</u>	<u>Miles Per Day</u>
0 - 300	47 (1.96 mph)
301 - 1100	88 (3.67 mph)
1101 - 1900	143 (5.96 mph)
1901 - 2400	182 (7.58 mph)

Table B4-2 presents the estimated shipping distances involved for rail shipments of spent fuel between the various shipping and receiving locations considered and the estimated time required to complete a round trip shipment.

*Pacific Northwest Laboratory, Truck and Rail Charges for Shipping Spent Fuel and Nuclear Waste, PNL-5797, June 1986

TABLE B4-2
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF SPENT FUEL
BY IF-300 RAIL CASK

Reactor to Destination	Round Trip Distance (Miles)	Round Trip Rail Transit Time (Hours)	Round Trip Heavy Haul Time (Hours)	Round Trip Heavy Haul Transfer Time (Hours)	Turnaround Time (Hours)	Total Time (Hours)	Total Time (Days)
From Palisades to							
Eastern U.S. Site	1,168	318.3	-	0	144	462.3	19.3
Western U.S. Site	3,402	570.8	9.0	8	144	731.8	30.5
From St. Lucie to							
Eastern U.S. Site	1,558	424.5	3.3	8	144	579.8	24.2
Western U.S. Site	5,454	719.5	12.3	16	144	891.8	37.2
From Robinson to							
Eastern U.S. Site	794	216.3	-	0	144	360.3	15.0
Western U.S. Site	4,664	615.3	9.0	8	144	776.3	32.3
From Brunswick to							
Eastern U.S. Site	976	265.9	-	0	144	409.9	17.1
Western U.S. Site	5,054	666.8	9.0	8	144	827.8	34.5
From LaSalle to							
Eastern U.S. Site	1,080	294.3	-	0	144	438.3	18.3
Western U.S. Site	3,170	531.9	9.0	8	144	692.9	28.9
From Oconee to							
Eastern U.S. Site	594	303.1	3.3	8	144	458.4	19.1
Western U.S. Site	4,510	595.0	12.3	16	144	767.3	32.0
From Pilgrim to							
Eastern U.S. Site	2,044	556.9	8.3	8	144	717.2	29.9
Western U.S. Site	5,210	687.3	17.3	16	144	864.6	36.0
From Indian Point to							
Eastern U.S. Site	1,632	444.7	1.7	8	144	598.4	24.9
Western U.S. Site	4,910	647.8	10.7	16	144	818.5	34.1

TABLE B4-2 (Continued)
 DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF SPENT FUEL
 BY IF-300 RAIL CASK

<u>Reactor to Destination</u>	<u>Round Trip Distance (Miles)</u>	<u>Round Trip Rail Transit Time (Hours)</u>	<u>Round Trip Heavy Haul Time (Hours)</u>	<u>Round Trip Heavy Haul Transfer Time (Hours)</u>	<u>Turnaround Time (Hours)</u>	<u>Total Time (Hours)</u>	<u>Total Time (Days)</u>
<u>From Millstone to</u>							
Eastern U.S. Site	1,812	493.8	1.7	8	144	647.5	27.0
Western U.S. Site	5,130	676.8	10.7	16	144	847.5	35.3
<u>From Prairie Island to</u>							
Eastern U.S. Site	1,758	479.0	-	0	144	623.0	26.0
Western U.S. Site	2,624	440.3	9.0	8	144	601.3	25.1
<u>From La Crosse to</u>							
Eastern U.S. Site	1,584	431.6	-	0	144	575.6	24.0
Western U.S. Site	2,724	457.0	9.0	8	144	618.0	25.7
<u>From Calvert Cliffs to</u>							
Eastern U.S. Site	1,130	307.9	16.7	8	144	476.6	19.9
Western U.S. Site	4,754	627.2	25.7	16	144	812.9	33.9
<u>From Oyster Creek to</u>							
Eastern U.S. Site	1,456	396.7	8.3	8	144	557.0	23.2
Western U.S. Site	4,954	653.6	17.3	16	144	830.9	34.6
<u>From Byron to</u>							
Eastern U.S. Site	1,270	346.0	-	0	144	490.0	20.4
Western U.S. Site	3,060	513.4	9.0	8	144	674.4	28.1
<u>From Ft. Calhoun to</u>							
Eastern U.S. Site	2,112	575.5	2.0	8	144	729.5	30.4
Western U.S. Site	2,200	599.4	11.0	16	144	770.4	32.1

5.0 TOTAL COST OF TRANSPORT OF SPENT FUEL TO A FEDERAL INTERIM STORAGE FACILITY

The total estimated costs of transporting spent fuel from 20 specific reactors to two typical locations are shown in the following tables. Table B5-1 details those costs which can reasonably be expected to be incurred when transporting spent fuel by truck. Table B5-2 shows the estimates of the total cost of transporting spent fuel by rail. Both of these tables have been compiled utilizing the assumptions outlined in Sections 1.0 through 4.0 of this Exhibit B.

TABLE B5-1
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1988 Dollars)

Reactor To Destination	Cask Use & Service Charge	Freight Charge ^b		Security Charge		Vehicle Detention Charge	Escort Charge	Total Cost	Total Cost (\$/MTU) ^c
		Loaded	Empty	Loaded	Empty				
From Palisades to									
Eastern U.S. Site	\$3,864	\$2,176	\$1,445	\$ 700	\$ 106	\$ 740	\$ 919	\$ 9,949	\$ 21,582
Western U.S. Site	7,303	5,233	3,917	1,922	291	740	1,103	20,509	44,487
From St. Lucie to									
Eastern U.S. Site	4,369	2,519	1,795	879	133	740	1,470	11,906	25,827
Western U.S. Site	10,220	7,967	5,995	2,948	450	740	2,757	31,077	67,412
From Robinson to									
Eastern U.S. Site	2,997	1,602	926	392	59	740	735	7,452	16,164
Western U.S. Site	10,148	7,967	5,995	2,933	444	740	2,757	30,984	67,210
From Brunswick to									
Eastern U.S. Site	3,634	2,038	1,320	618	94	740	735	9,180	25,081
Western U.S. Site	9,994	7,840	5,894	2,878	436	740	2,573	30,356	82,940
From LaSalle to									
Eastern U.S. Site	3,597	1,989	1,272	605	92	740	919	9,213	25,173
Western U.S. Site	6,625	4,528	3,360	1,681	255	740	919	18,107	49,473
From Oconee to									
Eastern U.S. Site	2,497	1,264	715	214	32	740	919	6,383	13,845
Western U.S. Site	8,927	6,757	5,093	2,499	379	740	2,573	26,967	58,497
From Pilgrim to									
Eastern U.S. Site	4,851	2,891	2,141	1,051	159	740	919	12,751	34,339
Western U.S. Site	9,854	7,693	5,770	2,828	429	740	2,022	29,336	80,152
From Indian Point to									
Eastern U.S. Site	5,336	3,288	2,462	1,223	185	740	1,103	14,338	31,101
Western U.S. Site	9,539	7,424	5,549	2,716	412	740	2,022	28,401	61,606
From Millstone to									
Eastern U.S. Site	4,705	2,744	2,021	999	151	740	919	12,278	26,634
Western U.S. Site	9,763	7,566	5,674	2,796	424	740	1,838	28,799	62,471

TABLE B5-1 (Continued)
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1988 Dollars)

Reactor To Destination	Cask Use & Service Charge	Freight Charge ^b		Security Charge		Vehicle Detention Charge	Escort Charge	Total Cost	Total Cost (\$/MTU) ^c
		Loaded	Empty	Loaded	Empty				
From Prairie Island to									
Eastern U.S. Site	\$5,046	\$3,033	\$2,242	\$1,120	\$170	\$740	\$1,470	\$13,821	\$29,980
Western U.S. Site	6,516	4,484	3,317	1,642	249	740	1,470	18,418	39,953
From La Crosse to									
Eastern U.S. Site	4,553	2,656	1,901	945	143	740	1,286	12,224	33,398
Western U.S. Site	6,220	4,190	3,091	1,537	233	740	919	16,930	46,257
From Calvert Cliffs to									
Eastern U.S. Site	3,735	2,083	1,378	654	99	740	735	9,423	20,441
Western U.S. Site	9,191	7,002	5,328	2,593	393	740	1,654	26,901	58,354
From Oyster Creek to									
Eastern U.S. Site	4,162	2,362	1,666	805	122	740	1,103	10,960	29,945
Western U.S. Site	9,469	7,286	5,434	2,692	408	740	2,021	28,051	76,641
From Byron to									
Eastern U.S. Site	3,789	2,132	1,378	673	102	740	735	9,549	20,713
Western U.S. Site	6,195	4,126	3,091	1,528	232	740	1,470	17,382	37,704
From Ft. Calhoun to									
Eastern U.S. Site	4,929	2,950	2,198	1,078	163	740	1,103	13,161	28,549
Western U.S. Site	5,144	2,832	2,126	1,155	175	740	1,103	13,275	28,795

^aBased on use of M1 1/2 truck cask with capacity for either one PWR or two BWR fuel assemblies.

^bBased on 49,000 lb gross shipping weight loaded, and 48,000 lb gross shipping weight empty.

^cBased on 0.461 MTU/PWR assembly and 0.183 MTU/BWR assembly, as introduced into the reactor. Unit cost will increase or decrease proportionately to corresponding decreases or increases in the uranium content of the fuel assemblies.

TABLE B5-2
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1988 Dollars)

<u>Reactor to Destination</u>	<u>Cask Use & Service Charge</u>	<u>Heavy Haul Charge</u>	<u>Rail Freight Charge^b</u>	<u>Escort Charge</u>	<u>Total Cost</u>	<u>Unit Cost (\$/MTU)^c</u>
<u>From Palisades to</u>						
Eastern U.S. Site	\$ 67,412	\$ 0	\$ 20,516	\$ 5,884	\$ 93,812	\$ 29,071
Western U.S. Site	106,722	9,458	42,799	10,509	169,487	52,522
<u>From St. Lucie to</u>						
Eastern U.S. Site	84,562	9,220	24,098	7,602	125,482	38,885
Western U.S. Site	130,054	18,678	56,120	13,538	218,390	67,676
<u>From Robinson to</u>						
Eastern U.S. Site	52,551	0	16,553	4,237	73,340	22,727
Western U.S. Site	113,211	9,458	53,685	11,684	188,038	58,270
<u>From Brunswick to</u>						
Eastern U.S. Site	59,783	0	18,622	5,038	83,443	25,332
Western U.S. Site	120,714	9,458	55,181	12,600	197,953	60,095
<u>From LaSalle to</u>						
Eastern U.S. Site	63,916	0	18,510	5,496	87,922	26,692
Western U.S. Site	101,045	9,458	40,379	9,843	160,724	48,793
<u>From Oconee to</u>						
Eastern U.S. Site	66,849	8,968	14,484	5,423	95,725	29,664
Western U.S. Site	111,901	18,426	50,486	11,323	192,136	59,540
<u>From Pilgrim to</u>						
Eastern U.S. Site	104,604	9,478	27,758	9,742	151,582	46,017
Western U.S. Site	126,098	18,936	55,898	12,966	213,897	64,935
<u>From Indian Point to</u>						
Eastern U.S. Site	87,260	8,826	24,909	7,927	128,922	39,951
Western U.S. Site	119,354	18,284	54,799	12,262	204,698	63,433
<u>From Millstone to</u>						
Eastern U.S. Site	94,412	8,858	26,500	8,720	138,490	42,916
Western U.S. Site	123,586	18,316	55,898	12,778	210,577	65,255

TABLE B5-2 (Continued)
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1988 Dollars)

Reactor to Destination	Cask Use & Service Charge	Heavy Haul Charge	Rail Freight Charge ^b	Escort Charge	Total Cost	Unit Cost (\$MTU) ^c
<u>From Prairie Island to</u>						
Eastern U.S. Site	\$ 90,857	\$ 0	\$27,328	\$8,482	\$126,667	\$39,252
Western U.S. Site	87,685	9,458	38,390	8,275	143,808	44,564
<u>From La Crosse to</u>						
Eastern U.S. Site	83,943	0	25,657	7,716	117,316	35,615
Western U.S. Site	90,132	9,458	38,962	8,562	147,114	44,661
<u>From Calvert Cliffs to</u>						
Eastern U.S. Site	69,500	12,438	20,198	5,716	107,851	33,422
Western U.S. Site	118,540	21,896	52,889	11,896	205,220	63,595
<u>From Oyster Creek to</u>						
Eastern U.S. Site	81,238	10,643	23,349	7,152	122,383	37,153
Western U.S. Site	121,172	20,101	54,418	12,365	208,056	63,162
<u>From Byron to</u>						
Eastern U.S. Site	71,465	0	22,235	6,333	100,033	30,999
Western U.S. Site	98,353	9,458	36,814	9,527	154,152	47,770
<u>From Ft. Calhoun to</u>						
Eastern U.S. Site	116,648	8,857	29,891	11,072	166,468	51,586
Western U.S. Site	112,358	18,315	30,607	10,429	171,709	53,210

^aBased on use of IF-300 rail cask with capacity for either 7 PWR or 18 BWR fuel assemblies.

^bBased on 164,000 lb gross shipping weight loaded, and 154,000 lb gross shipping weight empty. Reductions in rail freight charges may be possible through individual case negotiations with the railroads.

^cBased on 0.461 MTU/PWR assembly and 0.183 MTU/BWR assembly, as introduced into the reactor. Unit cost will increase or decrease proportionately to corresponding decreases or increases in the uranium content of the fuel assemblies.

EXHIBIT C

FIS SPENT FUEL ACCEPTANCE CRITERIA

EXHIBIT C
FIS SPENT FUEL ACCEPTANCE CRITERIA

1.0 GENERAL CRITERIA

The following sets forth the general criteria applicable to spent fuel acceptance for FIS:

- (1) The spent fuel shall have been used only in a commercial nuclear power plant operated in the United States.
- (2) The overall length of any PWR fuel assembly, or any canister of consolidated PWR fuel rods, shall not exceed 179-inches. The overall length of any BWR fuel assembly, or any canister of consolidated BWR fuel rods, shall not exceed 179-inches.
- (3) The maximum cross-sectional envelope dimension of any PWR assembly, or any canister of consolidated PWR fuel rods, shall not exceed 9-inches. The maximum cross-sectional envelope dimension of any BWR assembly, or any canister of consolidated BWR fuel rods, shall not exceed 6-inches.
- (4) The spent fuel shall not be defective, as defined in Section 2.0 of this Exhibit C.
- (5) The uranium contained in the spent fuel prior to irradiation shall not contain more than 3.5% uranium-235.
- (6) The spent fuel assemblies and the spent fuel assemblies from which canistered consolidated rods originated shall not have a thermal output in excess of 1 kW/assembly for PWR fuel and 0.4 kW/assembly for BWR fuel.
- (7) The canister used to contain consolidated fuel rods shall be constructed of stainless steel, shall be no less than a nominal 3/16-inch in thickness and shall be sealed by either welding or a metal-gasketed flange. The canister shall be free of residual water.
- (8) A detailed description of the spent fuel assemblies or canistered spent fuel rods, in both the form and detail prescribed by the Department, shall be submitted by the owner of the reactor from which the fuel was discharged. This description shall be examined by the Department and the Department shall have made a written finding that the spent fuel is compatible with handling and storage capabilities of the FIS facilities.

NON-DEFECTIVE FUEL

Non-defective fuel shall be defined as:

- (1) spent fuel assemblies which meet the general specifications set forth in Section 1.0 of this Exhibit C, which have been visually examined using underwater periscopes and/or remote TV scanning over the full length of all sides of the fuel assembly, no earlier than 180 days prior to the scheduled date of delivery to the Department, and which show no obvious evidence of existence of any of the following conditions to an extent which would require special handling or encapsulation at the FIS facility:
 - (a) fuel rod distortion
 - (b) cladding rupture or deterioration
 - (c) structural damage
 - (d) other condition of either the fuel rod(s) or assembly structure that is likely to result in (a) through (c), above, during transport to the FIS facilities or to interfere with the routine handling of the spent fuel assemblies at the FIS.
- (2) canisters of consolidated fuel rods, which meet the general specifications set forth in Section 1.0 of this Exhibit C, and which have been pressure tested, no earlier than 90 days prior to the scheduled date of delivery to the Department, and have been found to lose no pressure over a period of 4 hours when pressurized to no less than 50 psig.
- (3) spent fuel assemblies and canisters of consolidated fuel rods, meeting the applicable requirements of (1), above, for which certifications have been submitted to the Department regarding the details of the measurements and observations made and the results thereof.
- (4) spent fuel assemblies and canisters of consolidated fuel rods, meeting the applicable requirements of (1), (2) and (3), above, and which have been determined by the Department to be in condition suitable for storage after receipt at the FIS facilities.
- (5) spent fuel assemblies and canisters of consolidated fuel rods meeting the general specifications set forth in Section 1.0 of this Exhibit C and the applicable requirements of (1), (2), (3) and (4), above, and (a) for which the utility has performed a calculation of the expected thermal emission rate and shall have verified that no fuel assembly to be delivered to the

Department in the form of fuel as spent fuel assemblies or canistered consolidated spent fuel rods exceeds the maximum value set forth in Section 1.0(6) of this Exhibit C, and the Purchaser has delivered to the Department the analysis of the expected thermal emission rate of the spent fuel assembly or canister of consolidated fuel rods as of no earlier than 90 days before the date of delivery of the spent fuel to the Department, or (b) for which the utility has delivered a certification to the Department that no assembly to be delivered for FIS has been discharged from the reactor for less than 8 years.

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